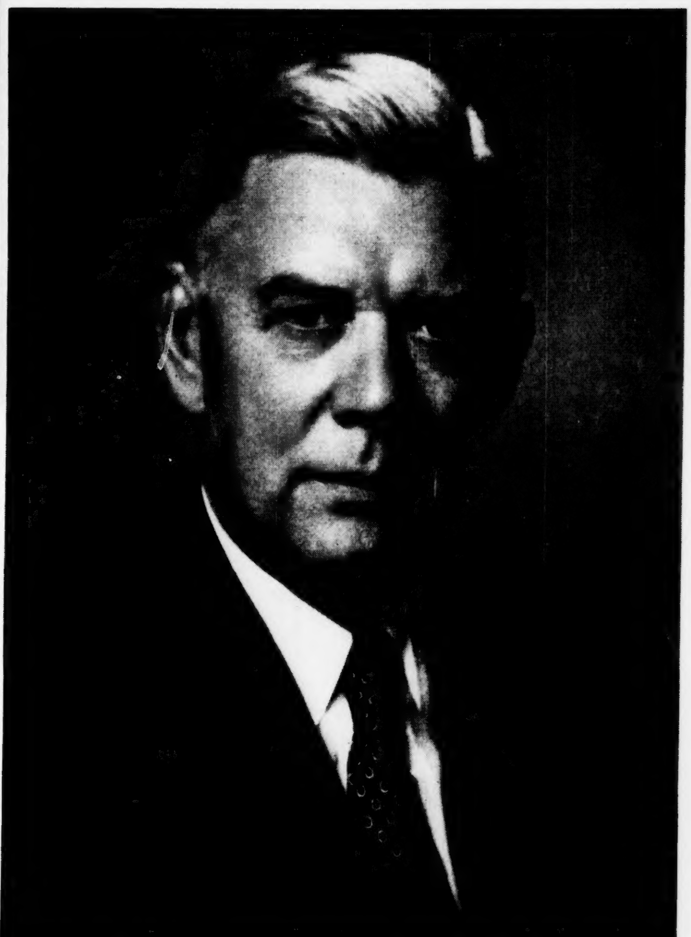
Metals Review

ASM

April 1958



Carl L. Ipsen
Retired Vice-President
I.H.E.A.
(See Article, p. 4)

Metals Review

The News Digest Magazine

April 1958
Vol. XXXI, No. 4

Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio: G. M. Young, President; C. H. Lorig, Vice-President; R. H. Aborn, Treasurer; W. H. Eisenman, Secretary; G. A. Fisher, Carl E. Swartz, John Hollomon and E. E. Stansbury, Trustees; D. S. Clark, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930 at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.

Claims for missing numbers will not be allowed if received more than 60 days from date of issue. No claims allowed from subscribers from overseas, or because of failure to notify the circulation department of a change of address or because copy is "missing from files".

Reprint Issue

Important Lectures

Departments

ASM Review of Metal Literature

Carl L. Ipsen, Retired Vice-President Industrial Heating Equipment Association

THERE'S a flower-flashed island off Florida's west coast where a retired businessman can survey the westering of his days, can sail his own boat in leeward waters, can coach his grandchildren for careers to come.

There is where Carl L. Ipsen, A.S.M., twice a valedictorian to industry and commerce, has been since his 68th birthday last Sept. 7. That is when he decided to retire as executive vice-president of the Industrial Heating Equipment Association.

Carl Laurencious* Ipsen accomplished his first retirement in 1953, after 40 years with General Electric Co. He had started there immediately upon being graduated in electrical engineering from Kansas State College. His business preceptor was G.E.'s late Magnus Washington Alexander, mechanical engineer, electrical engineer, industrial economist. The disciple progressed from test engineer, to salesman, to sales manager, to chief engineer of the industrial heating department, to sales manager, to general manager. After a year's leave of absence with the National Production Authority's industrial heating section he became consultant to General Electric.

That was tops, and sufficient for the one-time Kansas farm boy who had been working since he reached the ripe age of fourteen.

But the old Industrial Furnace Manufacturers Association, many of whose members were impatient with their industry's state, asked him, who had once been their president, to take the job of executive vice-president and soft-talk them into prospering harmony. He agreed to take the job for a short term if headquarters were moved from New York to Washington.

He got the Association's name changed to its present Industrial Heating Equipment Association, which is more exact because the products no longer are "tin cans lined with bricks", but precision machines as complicated and costly as machine tools. He improved liaison with Government agencies; brought more "big names" into the organization; elaborated public relations; got member corporations to display and their technologists to speak at the National and Western Metal Congresses and Expositions; has fostered yearly heating equipment sales to more than $115,000,000 in 1957; foresees equipment trends toward more automation, higher temperatures, more uses of protective atmospheres.

This retirement is surely the end of *all* active business for him. One reason, of deepest importance to him, is the fact that I.H.E.A. have entrusted their closest business affairs to his keeping, and he will not utilize this pooled information in any capacity for any single concern. Left open in his mind—because at 68 he is informed, alert and vigorous—is the possibility of occasional teaching or occasional editing. It is hard to visualize such a man as doing completely nothing!

Yet most attractive is the twilight from Siesta Key when the sun darkens, the earth sinks into the sea and flames lick the sky—not of the Norsemen's twilight of their gods, not of a nuclear bomb burst—but of a man's own haven. *Skaal!*

**Kansas phonetization of Danish-Latin Laurentius.*

Describes Economics of Atomic Power Reactors

Speaker: D. P. Herron

American Standard
Atomic Energy Division

David P. Herron, director of Engineering, Atomic Energy Division of American Standard, spoke before the **Golden Gate Chapter** on the "Economics of Atomic Power."

Mr. Herron emphasized the aim of nuclear reactor technology in the United States toward the reduction of power cost from the present level of 20 mils per kwh. to a projected level of 7 mils per kwh. The use of more efficient heat transfer media, such as liquid sodium or liquid bismuth, could reduce power production costs drastically provided means could be found to solve the problems which accompany the use of such media.

Special note was made of the lead taken by the British government in power reactor sales policy where fuel cost and return refund on used fuel elements are guaranteed. The British reactor was described and advantages and disadvantages were compared with the United States pressurized water reactor.

The British Calder Hall reactor is a gas (CO_2) cooled, natural uranium, graphite moderated reactor of inherently very large size, having a 40 ft. diameter pressure vessel. This is in direct contrast to the United States development in which much emphasis has been placed on developing compact reactors of the water-cooled type suitable for use in submarines.

CO_2 is not as good a heat transfer medium as water but is relatively noncorrosive. Water, on the other hand, is corrosive to suitable reactor materials and will react with uranium metal if a leak develops in the fuel element cladding.

The wall of the Calder Hall reactor pressure vessel is 2 in. thick and subsequent designs have 4-in. thick walls. These vessels are welded and stress-relieved in the field.

The fuel elements in the Calder Hall reactor are cast in magnesium alloy (Magnox) cans. Magnesium does not alloy with uranium, but does restrict the maximum surface temperature in dry CO_2 to 400° C. The CO_2 gas flows out of the pressure vessel at 637° F. and 100 psi. and into the heat exchanger by means of variable speed blowers. The heat exchanger delivers steam to a two-stage turbo generator at 590° F. and 200 psi. and 340° F. and 53 psi.

The size of the Calder Hall type of reactor can be increased without a corresponding change in cost, thereby reducing the total cost of power produced.

The United States pressurized-water (Shippingport) reactor uses water under high pressure and temperature as a heat transfer medium. The water also acts as a moderator and absorbs neutrons to the extent that the uranium fuel must be enriched. The fuel elements are clad with zirconium and the corresponding cost of fuel elements is five to six times as high as the cost of the fuel elements in the Calder Hall reactor, although the quality is superior. The pressurized water reactor delivers water to the heat exchanger at 2000 psi. and 542° F. The heat exchanger in turn delivers steam to a single stage turbo generator at 600 psi. and 486° F.

In conclusion it was mentioned that the Calder Hall reactor is operating very close to the upper limits of the design. On the other hand, the pressurized water reactor core was designed using quite conservative values for heat flux and ultimately heat fluxes of two or three times the design values may be attainable.—**Reported by Fred R. Sullivan for Golden Gate.**

For a Preview of the
A. S. M. of Tomorrow
See p. 32-33

A.S.M. Technical Program

SOUTHWESTERN METAL CONGRESS

Dallas, Tex. May 12-16, 1958

Monday, May 12
9:00 a.m.
Embassy Room, Statler-Hilton Hotel
SHEET MATERIALS FOR HIGH-TEMPERATURE SERVICE

Chairman: F. G. Tatnall, Tatnall Measuring Systems Co., Phoenixville, Pa.

Application of 17-7PH and Other Stainless Steels, by Robert W. White, Structures Materials Research and Development, Chance Vought Aircraft, Inc., Dallas.

High Alloys of Chromium, Cobalt, Vanadium, Columbium and Molybdenum, by H. R. Ogden, Consultant, Nonferrous Physical Metallurgy, Battelle Memorial Institute, Columbus, Ohio.

Ceramic Coatings for Protection of High-Temperature Materials, by Nathaniel Cannistraro, Director of Research and Development, Bettinger Corp., Waltham, Mass.

2:00 p.m.
Auditorium, Texas Hall of State
Dallas Fair Grounds

Chairman: L. H. McCreery, Supervisor, Engineering Structures Materials, Chance Vought Aircraft, Inc., Dallas, Tex.

High-Temperature Electrical Strain Measurements, by James E. Starr, Chief Electronics Engineer, Tatnall Measuring Systems Co., Phoenixville, Pa.

Cold Roll Forming Process as Applied to Semi-Austenitic Stainless Steel, by Frank Jacobs, Senior Supervisor, Engineering Metallics, Temco Aircraft Corp., Dallas.

Joining and Inspection of Joints, by J. C. Herr, Chief Metallurgist, Process Control, Convair, Ft. Worth.

Tuesday, May 13
9:00 a.m.
Embassy Room, Statler-Hilton Hotel
HIGH-STRENGTH STEELS FOR AIRCRAFT

Chairman: William D. Gilder, Chief Metallurgist, Reed Roller Bit Co., Houston, Tex.

Chromium Ultra-High-Strength Steels, by J. P. Hamaker, Jr., Manager, Research Dept., Vanadium-Alloys Steel Co., Latrobe, Pa.

Steel Castings in Airframes, by John K. Dietz, Engineering Structures Materials, Chance Vought Aircraft, Inc., Dallas.

Use of Steel Forgings at High-Strength Levels, by C. E. Moeller, Chief Metallurgist, Menasco Manufacturing Co., Burbank, Calif.

Machining and Fabricating High-Strength Steels, by Paul Kikeli, Director of Quality Control, Cleveland Pneumatic Tool Co., Cleveland.

2:00 p.m.
Auditorium, Texas Hall of State
Dallas Fair Grounds

Chairman: B. A. Rogers, Research Engineer, Texas Engineering Experiment Station, College Station

Embrittlement of High-Strength Steels, by E. P. Klier, Dept. of Chemical and Metallurgical Engineering, Syracuse University, Syracuse, N. Y.

Acceptance Testing of High-Strength Steels, by S. Goodman, Lead Metallurgical Engineer, Chance Vought Aircraft Inc., Dallas.

Transverse Properties of Steels, by J. M. Clark, Chief Engineering Metallurgist, Convair, Ft. Worth.

Practical Application of the Tempering Parameter Technique for 410 and 416 Stainless Steels, by Charles Lewis, Metallurgical Engineer, Cook Heat Treating Co., Houston, Tex. (Paper sponsored by the Southwestern Section, Metal Treating Institute).

Wednesday, May 14
9:00 a.m.
Embassy Room, Statler-Hilton Hotel
NEW FABRICATION TECHNIQUES

Chairman: E. W. Feddersen, Chief of Manufacturing Research and Development, Convair, Ft. Worth

Electro-Discharge Machining—Theory and Practice, by R. O. Williams, Senior Research Supervisor, P. E. Berghausen, Research Supervisor, and William B. Kane, Special Machine Tool Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.

High-Speed Machining, by E. K. Henrickson, Project Manufacturing Research Engineer, Convair, Ft. Worth.

Chemical Milling, by Roy Chandler, Plant Superintendent, Anadite, Inc. of Texas, Hurst.

Impact Extruding, by M. A. Ziegler, Impact Extrusion Project Engineer, Aluminum Co. of America, Edgewater, N. J.

2:00 p.m.
Auditorium, Texas Hall of State
Dallas Fair Grounds

Chairman: Allen Gray, Editor, *Metal Progress*

Forming at Elevated Temperatures, by Harry B. Osborn, Jr., Tocco Div., Ohio Crankshaft Co., Cleveland.

Adhesive Bonding, by W. S. Hay, Supervisor of Production Producibility, Convair, Ft. Worth.

Some of the Growing Pains of B-58 Sandwich Construction, by E. H. Watts, Chief Structures Engineer, Convair, Ft. Worth.

New Concepts of Weld Metal in High-Strength Fabrication, by D. C. Smith, Chief Metallurgist, and W. E. Rinehart, Research Metallurgist, Electrode Div., Harnischfeger Corp., Milwaukee, Wis.

Thursday, May 15
9:00 a.m.
Embassy Room, Statler-Hilton Hotel
CORROSION IN THE PETROLEUM AND CHEMICAL INDUSTRIES

Chairman: P. L. Willson, Chief Metallurgist, Halliburton Oil Well Cementing Co., Duncan, Okla.

Corrosion Resistant Alloys, by R. J. Rice, Texas Technical Section, International Nickel Co. Inc., Houston.

Metallic Coatings for Corrosion Protection, by Jack Eggleston, President, Vapor Honing Co., Houston.

Nonmetallic Coatings for Corrosion Protection, by L. C. Edgar, Technical Manager, Tube-Kote, Inc., Houston.

2:00 p.m.
Auditorium, Texas Hall of State
Dallas Fair Grounds

Chairman: J. C. Spalding, Jr., Section Supervisor of Material and Equipment Engineering, Sun Oil Co., Dallas.

High-Temperature Corrosion Problems, by E. N. Skinner, Head, High-Temperature Section, Development and Research Div., International Nickel Co. Inc., New York.

Corrosion of Refinery Equipment by Aqueous H_2S, by R. V. Comeaux, Engineering Div., Humble Oil & Refining Co., Baytown, Tex.

Importance of Inspection in Painting for Corrosion Control, by R. M. Ives, Jr., Senior Technical Service Engineer, Humble Oil & Refining Co., Houston.

J. E. Cogan (Center), Eastern Representative for the National Machinery Co., Gave a Talk on "Modern Forging" During a Meeting Held Recently by the Wilmington Chapter. He is shown with two members during the meeting

Modern Forgings Topic at Wilmington

Speaker: J. E. Cogan
National Machinery Co.

At a recent meeting of the **Wilmington Chapter,** J. E. Cogan, eastern representative for the National Machinery Co., gave a talk on "Trends in Modern Forging". Aided by a technicolor motion picture, Mr. Cogan discussed three phases of forging—cold forging, hot forging and reducerol-maxipres forging.

In discussing each method, Mr. Cogan showed some of the latest types of machinery being used and stressed the newer, faster and more economical aspects of each machine. Shown at one point in the proceedings was a machine that was forging commutator blanks. These, prior to being forged, had been stamped out of solid stock. Forging resulted in a more economical product that was fully as good and perhaps, in some cases, better than the old method of production.

With the onset of World War II, tolerances became more and more important to the industry. Out of this quest came reducerol-maxipres forging. Currently, maxipres-type forging is being applied, to pick out one instance, to form jet aircraft engine blades. Here the finished forging falls within required tolerances and no further machining is needed.

The speaker showed many interesting samples, which he classified as "difficult to forge" and, whenever possible, related these examples to the talk. He said that the general trends in the industry today were towards automatic, high-speed forging that holds scrap loss to a minimum.

Effort, he said, is being made in modern forging operations to hold tolerances as close as possible on the finished product, thereby eliminating costly machining and other subsequent operations.—**Reported by Liston Noble, Jr., for Wilmington.**

Developments in Grinding Reviewed at Ottawa Valley

Speaker: G. W. Watts
Norton Co. of Canada Ltd.

G. M. Watts, manager of the sales engineering department, Norton Co. of Canada Ltd., addressed the **Ottawa Valley Chapter** on the subject of "New Developments in the Field of Grinding". Mr. Watts introduced his address with a film, "How to Select the Right Grinding Wheel".

Part of the film concerned the selection of the right wheel for a specific job and six factors were listed for consideration: The material to be ground and its hardness; the amount of stock to be removed and the finish required; whether the grinding is done wet or dry; the wheel speed; the area of grinding contact; and the severity of the grinding operation.

The film then went into further detail to show how each of one or more of these factors affected the choice of particular features of the grinding wheel. For example, the choice of abrasive depends upon the type of material to be ground and its hardness and upon the severity of the grinding operation.

In his address, Mr. Watts dealt with new abrasives under three major headings: ceramic cutting tools; reinforced resinoids; and precision barrel finishing.

Ceramic cutting tools are made from abrasives, such as aluminum oxide, which are formed by high pressures and temperatures. These tools are gradually finding a place in industry as a result of good tool life, superior finish, high-speed operation and their excellent size control characteristic. The main deficiency is poor shock resistance.

Reinforced resinoids are made by the molding of layers of fiber glass cloth into the composition of the wheel. These wheels are particularly strong and, although breakable, will not fly apart or fragment.

Precision barrel finishing removes burrs, rust, blends radii, and generally improves and brightens the finish. It eliminates many slow and costly hand operations and it is claimed that it improves fatigue life by its peening action and by the removal of the directional property of scratches.

The speaker described several types of abrasives and stated that each shape, size, and type of abrasive has a particular and diversified application of which several examples were given.—**Reported by R. D. McDonald for Ottawa Valley Chapter.**

—PROGRESS THROUGH METAL SCIENCE—

A.E.C. Head Looks to Continued A.S.M. Aid

America will remain strong if technical and educational organizations stimulate the desire for knowledge, said Admiral Louis Strauss, chairman of the United States Atomic Energy Commission, in a recent letter to William H. Eisenman.

Replying to a communication sent to him by Mr. Eisenman early in December, Admiral Strauss said:

"It is always a pleasure to hear that the activities of the staff of the A.E.C. and its principal contractors in organizations such as the American Society for Metals are appreciated.

"Close cooperation between organizations with powers to stimulate the quest for knowledge and disseminate information is essential to the maintenance of a strong America. You have our assurance of the desire to continue this relationship and we join you in the hope that this series of meetings will have an extended life".

Compares Aluminum and Tin Cans

Robert M. Brick, Director of Research Metallurgy, Continental Can Co., Spoke Before the Los Alamos Chapter on "Aluminum Cans Versus Tin Cans". Shown are, from left: F. W. Schonfeld, chairman; Dr. Brick; and R. B. Gibney, the technical chairman. (Reported by R. W. Keil for Los Alamos)

Arc-Cast Molybdenum and Its Alloys Are Described

Speaker: George A. Timmons

Climax Molybdenum Co. of Michigan

George A. Timmons, vice-president and director of research, Climax Molybdenum Co. of Michigan, presented a talk on "Arc-Cast Molybdenum and Its Alloys" at a meeting held by the **Washington Chapter.**

Mr. Timmons indicated that the primary objective of the development of the arc - casting process for molybdenum has been the production of large sections of the metal and its alloys for structural applications at temperature levels where no other alloy system has been able to satisfy the requirements.

Since 1943, the largest single aggregate of molybdenum has been increased from pressed and sintered bars, 1¼ in. square, weighing 17 to 18 lb., to castings 12 in. in diameter, weighing 1800 lb. And, whereas molybdenum was available in 1943 only as wire and narrow-width sheet for electronic and a few other uses, today wrought molybdenum and its alloys are available as extruded sections, forgings, sheets and plates.

Mr. Timmons stated that castings should have a maximum of 0.005% (50 ppm.) oxygen to be forgeable, and recent developments have indicated that lower oxygen contents are desirable for developing good mechanical properties in wrought shapes. Deoxidation, therefore, attains major importance in the melting process.

Oxygen itself can be removed from molten molybdenum under vacuum. However, repeated meltings under vacuum are required to reduce the oxygen to a level which would make the metal suitable for forging or beneficial "hot" working. Since adequate deoxidation cannot be accomplished in a single step by simple outgassing alone, the required deoxidation is effected by reacting the oxygen with carbon and removing carbon monoxide under vacuum.

Molybdenum alloys readily with a number of metallic elements. One group—tungsten, vanadium, titanium, tantalum, columbium and chromium, form a continuous series of solid solutions with molybdenum. Iron, nickel, cobalt, aluminum and silicon will produce excess phases in the binary alloys at concentrations less than 2%; the hardness of alloys with only small concentrations of these elements is so high that they are not amenable to forging by present commercial practice.

Arc-cast molybdenum and its alloys pose some unusual problems in fabrication, because the only facilities available for forging, rolling and extruding have been equipped for working steel at maximum temperatures near 2200° F. If molybdenum were worked at the temperature equivalent to 80% of its melting point, it would necessitate heating to 3700° F. for each operation. Limiting the maximum working temperature for cast molybdenum to 2300° F. is equivalent to rolling a steel ingot at 1200° F. Highly strain-hardened bars of unalloyed molybdenum recrystallize at 2150° F., but some of the alloys require temperatures in the range 2800-3000° F. to effect complete recrystallization in 1 hr. Such temperatures preclude the true hot working of molybdenum using available conventional heating and fabricating equipment.

Molybdenum alloyed with 0.5% titanium has been found to have outstanding high-temperature properties. There are reasons to believe that the high mechanical properties of this alloy are associated with interstitials, and studies now underway suggest that carbon may be a controlling factor.

It is anticipated that metal quality will be improved when higher purity powder becomes available through specially designed and precisely controlled processing, and when the establishment of metalworking facilities, built especially for refractory metals, makes true hot working a commercial reality.—**Reported by Roy M. Gustafson for Washington.**

—WORLD IMPROVEMENT WITH METALS—

Vacuum Induction Process And Applications Explained

Speaker: P. W. Beamer

Utica Drop Forge & Tool Division

P. W. Beamer, manager, pilot plants and new products, Metals Division, Utica Drop Forge & Tool Division, Kelsey-Hayes Co., spoke on "Vacuum Induction Melting and Application of Vacuum Melted Alloys" at a meeting of **Jackson Chapter.**

Vacuum induction is a commercial melting process which is capable of more metallurgical control than other commercial processes. It is a melting and refining technique which has been scaled up to production size. With this process it is possible to melt in the absence of detrimental gases and to produce alloys not previously possible by other known processes. The ability to maintain extremely close control of the chemistry of compositions is possible and therefore new groups of alloys that are sensitive to composition variations can be commercially produced.

Vacuum induction melting, with its ability to melt in the absence of oxygen, nitrogen and hydrogen, makes it possible to melt alloys containing large amounts of reactive additions such as titanium, aluminum and silicon. It also permits a degree of refinement of alloys in which the impurity level is reduced beyond that of our present production analytical methods, and has provided a means by which the effects of minute additions of certain trace elements on mechanical and physical properties may be explored.—**Reported by W. F. Stewart for Jackson.**

Describes Processing of Jetomic Irons

Harry Kessler, Developer of the Sorbo-Mat Process, Is Shown Delivering a Talk on "Processing of Jetomic Irons" at a Pittsburgh Chapter Meeting

Speaker: Harry Kessler
Sorbo-Mat Process Engineers

Members of the **Pittsburgh Chapter** heard Harry Kessler, Sorbo-Mat Process Engineers, and developer of the Sorbo-Mat Process, deliver a talk on the subject of "Processing of Jetomic Irons" at a recent meeting.

Mr. Kessler's talk was concerned primarily with the practical aspects of metallurgy in the iron foundry. He emphasized the importance of material background and control of raw materials in the development of desired properties in castings. He stated that entirely different properties could be obtained in castings with apparently the same composition which was rationalized in terms of the differences in combined and free carbon. The ability to control the distribution of carbon was related to the raw materials and Mr. Kessler described a rather unique classification system employed by his firm to predict properties based on raw material input. This system requires the calculation of a parameter described as the steel equivalent of a given raw material.

Mr. Kessler then presented a general discussion of some problems commonly encountered in the foundry industry. In addition to raw materials, it is necessary to maintain close control over wind rates and refractories to insure reproducible castings.

After the discussion period, Mr. Kessler showed movies of the Moore-Marciano fight which he refereed.—**Reported by A. J. Lena for Pittsburgh Chapter.**

Development of Research Is Described at Purdue

Speaker: David Swan
Linde Co.

The **Purdue Chapter** featured a talk by David Swan, director of research for the Linde Co., at its Management and Sustaining Members Night meeting on "Industrial Research, Why and How".

The payoff of successful industrial research lies in new capital expansion in our national economy. The research process takes place in two steps. The first consists of acquisition of ideas—these come from basic scientific study, invention, domestic and foreign literature, management and from market research. Market research also generally determines the probable industrial use of new products resulting from new ideas. The second step is application of the idea and demonstration of its value. Here pilot plants may be built and extensive development programs set up.

The economics of research was noted; every dollar invested in research results in an average $3 to $10 investment in new capital goods. Also, the percentage of return on capital investment determines the success of a research program. The goal of an industrial research program is to provide the management of the company with demonstration of the results possible from capital investment. The management is then able to choose those ventures with the best chance for profitable growth. Once research is established, however, its responsibilities to the company should be established.

Mr. Swan concluded with a report of his tour of Soviet Russia in the Fall of 1957. He outlined the Soviet economic system, which results in a highly centralized control of Soviet monies. Priority for money is given to selected programs, thus, Soviet Russia's rapid technical expansion; however, systems of lesser priority, such as agriculture, suffer from lack of funds.

The meeting was concluded with a brief discussion period.—**Reported by T. B. Lindemer for Purdue.**

—MASTERING METALS FOR MANKIND—

Louisville Hears Talk on Metal Finishing Methods

Speaker: Malcolm Fogg
Globe Chemical Co.

Malcolm Fogg, director of technical service for the Globe Chemical Co., spoke in **Louisville** on "Recent Developments in Metal Finishing".

Mr. Fogg discussed the electroplating process which was developed primarily for metallographic examination but which was later expanded into the metal finishing field.

The process consists of making the part the anode in an electrolytic bath of acids. This arrangement is opposite to that used in the electroplating process. A current density of from 100 to 300 amps per sq. ft. is normally used with a potential of from 5 to 15 volts. The parts require agitation during the electropolishing cycle. During the process the peaks on the metal surface are gradually removed until a relatively smooth surface is obtained. Most of the common metals and alloys can be electropolished, except leaded brasses or aluminum alloys containing substantial amounts of silicon.

Mr. Fogg mentioned the following advantages of the process: There is no damage or distortion to the surface being electropolished; adhesion of electroplate is much better on an electropolished surface than on a mechanically prepared surface; intricately shaped parts which cannot be hand buffed or tumbled can be electropolished; true metal colors are brought out in the process; uniform results are obtainable from unskilled labor; and the process can be made fully automatic with relatively simple controls.

It was brought out that in certain coarse-grained materials, prepolishing is necessary to avoid "orange peel" on the final surface. The process is now being used on electrical appliances, jewelry, automotive trim, plumbing fixtures, hardware, surgical instruments, etc. Many mechanical operations, such as deburring, can also be performed through the electropolishing technique.

The speaker also discussed the advantages of bronze plating from a corrosion standpoint. Data was presented showing the superiority of Lustralite-type bronze plate over conventional copper-nickel-chromium plate in weather tests conducted in various parts of the country.—**Reported by Chester C. Jenkins for Louisville.**

Quench Cracking in Steel Subject at Cincinnati

Speaker: J. W. Spretnak
Ohio State University

"Quench Cracking in Steel" was the subject of the talk given by J. W. Spretnak, professor, department of metallurgical engineering, Ohio State University, at a meeting held by the **Cincinnati Chapter.**

The heat treatment of steels and its associated problems has been with us for many years. Mr. Spretnak discussed the distortion and actual metal failure of steels in the heat treating operations. When thermal stresses only are present, distortion will be present but no cracking or metal separation will usually be experienced. When a transformational change (change in allotropic form) is encountered in heat treatment, cracking may occur if tensile stresses of sufficient magnitude result from the transformation change.

There are stresses in both the plastic and elastic temperature ranges. There are no thermal stresses in the plastic range, only in the elastic range. Residual stresses are the result of nonuniform plastic deformation.

German research on the origin of stresses in quenching was reviewed. The Sach's boring-out method was used for determining internal stresses. Longitudinal, tangential and radial stresses were measured on the parts tested. After these internal stresses were determined they were plotted showing the results using various treatments and steels. In the lower alloy steels, the thermal stresses reverse (from tension to compression) after the transformational stresses occur. In higher alloy steels (for example, 12 to 22% nickel), the reversal in stresses occurs before the transformation stresses begin. Consequently at room temperature there is no reversal and the case is left in tension. Tempering is then necessary to minimize cracking.

Mr. Spretnak then discussed the work done on heat treating of hollow cylinders, describing the methods of heat treatment devised to reduce breakage. After compiling large volumes of data, it was determined that the normal cracking in the bore was greatest in cylinders made from the bottom one-third of the steel ingot. This is due to the solidification cone in the ingot.

The following factors were listed as being important in the heat treatment of hollow cylinders: inclusion factor; carbon level—the higher the carbon level the greater the cracking potential; cracking can be reduced by increasing the finishing temperature if the hardness specification can be met at this temperature; uniform quench.

Under the last item, Dr. Spretnak discussed the work done on quenching the bore as well as the O.D. of the cylinder. In quenching from the O.D. the thermal mid-wall is normally 3/5 of the way in from the O.D. to the bore. By quenching the bore ahead of the O.D., this thermal mid-wall can be shifted. It is felt that the thermal mid-wall should be moved to the geometric center of the cylinder for the best balance in internal stresses. This thermal mid-wall movement can be controlled by quenching the bore first and then the O.D. The time differential between the initial quench of the bore and the quench of the O.D. is referred to as bore lead. By varying the bore lead, a desirable stress pattern can be obtained which will minimize the cracking in the bore.—**Reported by R. L. Bockstiegel for Cincinnati.**

—MODERN METALS FORETELL TOMORROW'S MARVELS—

Receives Past-Chairman's Certificate

William F. Collins (Left), Chairman, Boston Chapter, Is Shown Presenting a Past-Chairman's Certificate to Harold Stuck, Immediate Past Chairman

Speaks on Manufacture Of Anaconda Metals

Speaker: W. C. Farrow
Anaconda American Brass Ltd.

W. C. Farrow, sales representative, Anaconda American Brass Ltd., spoke to the **Manitoba Chapter** on the "Manufacture of Anaconda Metals".

Mr. Farrow mentioned that copper, the oldest of metals, still stands among the most useful to man and emphasized the fact that 50% of all copper produced is consumed by the electrical industry, a point worthy of reflection. This commercial metal, unequalled and unsurpassed as an electrical conductor, did much to make electrification, one of the greatest boons to our civilization, possible.

In the new and wonderful age of atomics for peace, who can measure the benefits of copper. Because of dangerous radiation in the handling of atomic energy for general use, its conversion into electrical energy is a recognized principle and hence a further expansion in the use of copper.

A review of the development of the copper industry in Canada revealed production of 3½ million lb. of copper in 1886. This output had grown to 706 million lb. in 1956. Early copper was produced by the blister or fire refining process, but in 1930 electrolytic refining took its place.

The highlight of the talk was the pictorial visit by color slides and the very enlightening commentary on the processes of converting copper and its alloys into the various shapes and forms at the Anaconda American Brass mill. The films covered the proportioning of raw materials and casting, the five-stand tandem rolling of copper in the bar and strip mill, the rod mill with its extrusion press process, the hot breakdown and cold rolling sheet mills and the Mannesmann piercer and multiple drawbench processes in the tube mill.

In conclusion, Mr. Farrow commented on some of the field investigations and explorations in the development of new mining properties by their subsidiary company, Anaconda (Canada) Ltd.—**Reported by J. E. Graver for Manitoba.**

A.S.M. created the Annual Teaching Award in Metallurgy, open to teachers of metallurgy in the United States and Canada. Value $2000.

At Worcester-Springfield Meeting

Leaders at a Joint Meeting of the Worcester and Springfield Chapters Were, From Left: Walter J. Nartowt, Worcester Chairman; Francis D. Looney, Springfield Chairman; Wayne H. Folger, Jr., Supervisor of Machine Sales, Heald Machine Co., Who Spoke on "Precision Grinding and Boring"; and Harold J. Holmes, Technical Chairman. (Reported by C. Weston Russell)

At Pittsburgh's Winter Festival

Bill Knapp, Bruce Shields and Arnold Belkin of the Entertainment Committee Receive Some Valuable Assistance in Awarding Door Prizes at the Annual Winter Festival Held by the Pittsburgh Chapter. The lucky prize winners are also shown. (Reported by A. J. Lena for Pittsburgh)

Columbus Student Receives Scholarship

From Left: Gerald K. Wood, Chairman of the Columbus Chapter, Looks on as Doyle Rausch, Sophomore in the Metallurgical Engineering Department, Ohio State University, Is Presented With an A.S.M. Certificate of Scholarship by Mars G. Fontana, Head of the Metallurgical Engineering Department

Quality Control Panel Outlines Its Advantages At Warren Meeting

Howard C. Dunkle, steel conservation engineer, Republic Steel Corp., Chester R. Smith, chairman of operations research, Sharon Steel Corp. and Mallory-Sharon Metals Corp., John G. Dunn, chief metallurgist, Republic Steel Corp., and Jack Manternach, Jr., manager of sales for plate and structural fabrication, Heltzel Steel Form & Iron Co., were members of a panel which discussed "Can Quality Control Help You?" at a joint meeting held by the **Warren Chapter A.S.M.** and the Youngstown Chapter of the American Society for Quality Control. Howard Boyer, managing editor, *Metals Handbook*, was the panel moderator.

Mr. Dunn, the first speaker, stressed the fact that there are two methods of quality control used throughout the metals industry; namely, the type generally used in basic steel where "on the job" inspection plays a more important role than the type generally used in fabrication where "charts" govern the control. The use of charts quite often adds confusion in interpretation, especially at critical stages of melting or rolling where the average employee is called upon to make a quick decision. The speaker indicated that the use of charts should be restrictive in application until a better method of presentation has been devised. However, he sees a future to its use.

Mr. Dunkle, with the aid of wall charts, explained absolute humidity data obtained from the airport to demonstrate the use of data and its role in everyday applications, especially in respect to the Bessemer plant operation.

Mr. Manternach described quality control as applied to welded steel applications with consideration given to the basic material specifications, proper methods of preparation, fitting and assembling for welding, shrinkage, warpage and, in general, identifications, markings and inspection.

Mr. Smith, in addition to his other affiliations, has for the past year and a half held the position of professor of statistics at Youngstown University. He emphasized that statistical quality control can be profitably applied to metal processing problems. It is just as important to know "how" and "why" to do a thing as it is to know "what" to do. Under the "how" column we must learn the theory, techniques and processes of statistical quality control. The "whys" involve such things as statistical quality control versus cost, responsibility for quality in the plant and responsibility for quality to the customer.—**Reported by T. P. LaVelle for Warren Chapter.**

Influence of Machining And Heat Treating on Field Failures Explained

Speaker: J. D. Graham
International Harvester Co.

John D. Graham, chief engineer, materials engineering and engineering standards, International Harvester Co., addressed the **Detroit Chapter** on the subject "Field Failures as Influenced by Heat Treatment and Machining".

Mr. Graham desecribed the various metallurgical and design factors which contribute to failure of metal parts. The relation of yield strength and endurance strength to applied loads through the cross-section of members loaded in tension, compression, bending and torsion was shown diagramatically. Examples of failures where the applied load at the surface or internally exceeded the design load on the part were illustrated. The effect of supplementary factors on the design strength such as surface stress concentrations resulting from machining of fillets, tool marks on finished surfaces, or notches resulting from handling, must also be considered.

The prominent role played by residual stress on the service performance and failure of parts was described. It was pointed out that the residual stresses produced by heat treatment, depending on their directions in relation to the applied stress at a given location on the cross-section of a part, can result in ultimate failure or a substantial improvement in safety factor. The relation of brittle versus ductile failures to material specifications, heat treatment and part design was illustrated. Also illustrated was how the ratio of cohesive strength to shear strength can be controlled to produce a brittle or ductile failure. It was shown that ductile failures occur in shear, whereas brittle failures are normally in tension.

Mr. Graham concluded by pointing out the useful information that can be obtained from examination of failed parts. Surface pitting resulting from wear, fatigue progression from a small radius, inadequate depth of hardening from low hardenability, surface failure due to decarburization from inadequate atmosphere during heat treatment, and brittle failures resulting from grain coarsening by too high heat treating temperatures were illustrated and discussed. In summary, Mr. Graham stated that all metallurgical and design factors must be balanced to insure that adequate strength is available in all areas of the part to withstand all combinations of applied loads during service life to prevent its premature failure.—**Reported by W. A. Bachman for Detroit.**

Surveys Russian Steelmaking

Lee Wilson, Chairman of the Board, Lee Wilson Engineering Co., Inc., Presented a "Personal Survey of Russian Steelmaking" at a Meeting Held in Kansas City Recently. Shown are, from left: Gerald Hummon, secretary; Mr. Wilson; Dave Goldberg, chairman; and Pat Kenyon, the vice-chairman

Rockford Members Enjoy Dinner-Dance

Members and Their Wives Enjoyed the Dinner-Dance Held by the Rockford Chapter. Shown, from left, are: Mrs. Bowen and Quentin Bowen, Jr., vice-chairman; Don Campbell, chairman, and Mrs. Campbell; and Mrs. Simonovich and Dick Simonovich, secretary. (Reported by G. W. Sandstrom)

Explains High-Temperature Brazing

Shown at a Recent Meeting of the Rhode Island Chapter Are, From Left: Clifford S. Ey, Vice-Chairman; R. R. Rupender, Advanced Manufacturing Engineer in the Flight Propulsion Department of General Electric Co., Who Spoke on "Brazing for High-Temperature Applications"; and William P. Matthew, Chairman. (Reported by Gordon Partington for Rhode Island)

A.S.M. Members' Names Added to Quarter Century Club Roster

The following A.S.M. members have been awarded honorary certificates commemorating 25 years consecutive membership in the Society:

Baltimore—Baltimore Tool Works, Gathmann Industrial Corp.

Boston—Russell S. Young.

Buffalo—Joseph H. Sander, James E. Wilson.

Calumet—D. R. Cornell, T. H. Sanderson.

Canton-Massillon—Leon E. Jeanneret, A. F. Sprankle.

Chicago—E. A. Anderson, A. M. Cornell, William J. Diekmann, Andrew G. Forrest, K. W. Graybill, James A. Leahy, Karl F. Schauwecker, H. M. Thornquist, Jack Wilson, Leon J. Wise.

Chicago-Western—Alfred S. Jameson, Albert P. Miessler, Elmer H. Snyder.

Cincinnati—Don M. Johnson, Ralph E. Oesper.

Cleveland — Russell G. Anderson, J. C. Beattie, Harold P. Blum, N. H. Brodell, Walter G. Hoffman, Peninsular Steel Co., Alexander M. Smith.

Columbus—C. T. Greenidge, Timken Roller Bearing Co.

Dayton—David Sauter.

Delaware Valley—T. Francis Conahan, Robert H. Saviers.

Detroit—Clarence F. Alban, Mark L. Beardslee, Harold H. Blackett, Cadillac Motor Car Co., C. G. Chambers, Howard E. DeHaven, Ford Motor Co., General Motors Corp. Research Laboratory, William A. McKee, C. B. Ross, George Timmons, H. N. Todt, R. E. Vincent, Henry E. Zechman.

Golden Gate—C. A. Blesch, John R. Cunningham, Carl W. Horack, George B. McMeans, John G. Pihl, G. L. VonPlanck.

Hartford—H. G. Runde.

Indianapolis—Gladstone C. Hill.

International — New South Wales Government Railways, Lewis Reeve, Reginald J. Williams.

Long Island—Fred Heinzelman, Jr.

Los Angeles — Matthew Charlton, George D. Hayden, George J. Moeller.

Milwaukee — Ampco Metal, Inc., Morris T. Roberts.

Montreal—Firth Brown Steels Ltd., Alfred H. Lewis.

National—State University of Iowa Libraries.

New Haven—Bridgeport Gas Light Co., John L. Christie, F. N. Meyer.

New Jersey — Aluminum Co. of America, John R. Anderson, G. Kingman Crosby, G. M. Rollason, Temperature Processing Co. Inc.

New York—C. W. Floyd Coffin, Frank J. Fieser, John Haydock, R. K. Hopkins, William C. Mearns, R. W. Moore, Oliver Smalley, Joseph R. Vilella, F. S. Walter.

North Texas—Charles J. McCarthy.

Ontario—C. W. Cassels, Minneapolis-Honeywell Regulator Co., Ltd.

Peoria—George E. Burks.

Philadelphia—Clinton K. Mitchell, Fred L. Spangler.

Pittsburgh—William E. Bayers, Jr., Leon C. Bibber, Harry E. Dowie, T. S. Fitch, Fulton B. Flick, Lester C. Hill, J. L. Holmquist, Max W. Lightner, Andrew K. Robertson, Howard J. Rowe, Richard W. Simon, Wilfred A. Sudekum, Alfred H. Ward.

Rhode Island—James E. Bullock.

Rochester—William J. Woerner.

Rome—Ernest R. Carr, Jr.

Saginaw Valley—Don P. Marquis.

St. Louis—Gerhard Ansel, Owens-Illinois Glass Co., Paul H. Walther.

Springfield—Alfred Ziegler.

Texas—William B. Brooks.

Toledo—Neil M. Waterbury.

Warren—Roy F. Lab.

Washington—John C. Barrett, William A. Pennington.

Worcester — Rudolph A. Johnson, George A. Peterson.

York—Bertrand S. Norris.

Heat Treating Methods Outlined at Syracuse

Speaker: E. L. Kemper
A. F. Holden Co.

Eugene L. Kemper, manager, product development, A. F. Holden Co., was the technical speaker at a recent meeting of the Syracuse Chapter. His talk covered the "Theoretical and Practical Aspects of Martempering, Austempering and Isothermal Heat Treatment Techniques".

The T-T-T diagrams are the heat treaters' road map. The most desirable quench is attained when you miss the nose of the S curve. Quenching refers to the rapid cooling of a metal usually in a liquid media. The metal progresses through three zones or stages in cooling; the first when the vapor barrier forms and cooling is slow, the second when this barrier breaks down and cooling is rapid, and the third stage when equilibrium is being reached and cooling is again slow. A very hard surface is formed while the core has not yet reached the Ms temperature and thus is still austenitic. This results in the formation of high stresses on the surface when the core does transform. To avoid these high stresses and to minimize distortion, martempering or austempering can be employed. The resulting transformation products in a properly martempered piece are the same and metallographically no difference is seen between this and a conventionally quenched piece.

The prime difference between conventional and isothermal annealing is in the drastic reduction of time that is possible.

Mr. Kemper used slides to show the equipment available in isothermal treatments and concluded his talk by stating that better control of quenching is necessary and that martempering and austempering are being overlooked in many instances. —**Reported by G. Trojanowski for Syracuse.**

Past Chairmen Are Guests at Cincinnati

Past Chairmen Who Recently Attended a Meeting of the Cincinnati Chapter Included, From Left: W. Wheland, Stan Ollinger, Walter Klayer, William Maddox, John Kahles, Kurt Siemes, M. Brumble, Reid Kenyon, Walter Archea, R. O. McDuffie, Ed Stenger and F. Westerman. (Reported by R. L. Bockstiegel for Cincinnati Chapter)

Metallurgical News and Developments

A Department of *Metals Review*, published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Devoted to News in the Metals Field of Special Interest to Students and Others

Nuclear Course—A nine-week course on "Nuclear Engineering" for those who need a basic knowledge and facility in nuclear engineering to complement their current skills and experience, to be held June 16 through Aug. 15, 1958, will be given by the University of California. For information write to: Engineering and Sciences Extension, Nuclear Energy Programs, Room 100, Bldg. T-11, University of California, Berkeley 4.

Cobalt References—The Cobalt Information Center, Battelle Memorial Institute, Columbus 1, Ohio, has announced the availability of three reference lists, Aluminum-Cobalt Alloys, Cobalt in Cast Iron, and Cobalt in Stainless Steel. Send your requests on company letterhead for free copies.

Vacuum Furnace—A laboratory vacuum furnace capable of attaining temperatures in excess of 2000° C. has been announced by Vacuum Equipment Division of the New York Air Brake Co. This F-9 vacuum furnace has a capacity of 10 lb. of steel or volume equivalent if the crucible is to be tilt-poured, and 25 lb. if bottom-plug pouring is employed.

Appoints Representative—General Alloys Co. has appointed National Furnace Sales and Service, Inc., 4827 Patata St., Bell, Calif., as sales-engineering representatives for California.

Melting and Casting Process—A process to melt and cast special metals, such as titanium, zirconium, tantalum, molybdenum and columbium, has been announced by Stauffer Chemical Co., Mallory-Sharon Metals Corp. and Temescal Metallurgical Corp. The process uses electron bombardment in a high vacuum to melt chemically active materials which have high melting points.

Metal Cutting Course—Massachusetts Institute of Technology will conduct a course on Metal Cutting from June 17 through June 27, 1958. Information from Mechanical Engineering Dept., M.I.T., Cambridge 39, Mass.

New Lubricant—A lubricant and rust preventive, called Hamicote, that prevents metal-to-metal contact, eliminates or reduces stickers and toxic fumes and stays on the metal insuring complete lubrication where needed has been developed by Harry Miller Corp., 4th and Bristol Sts., Philadelphia 40, for use in die casting, forging, drawing and stamping.

Announce Foundation—The Wheelabrator Corp. has announced the establishment of the Wheelabrator Foundation which has contributed $100,000 to the Foundry Educational Foundation. The grant will provide 50 fellowships of $1500 each to be distributed during the next ten years. The remainder of the grant, $25,000, can be used by the Foundry Educational Foundation for fellowships, scholarships or other educational purposes.

Die Casting Machine—DCMT Sales Corp., Division of British Industries Corp., has introduced a high-speed die casting machine that will produce zinc alloy castings up to 1 lb. in weight at production rates often exceeding 1500 shots per hr. and requires no operator.

Gas-Fired Furnace—A gas-fired carburizing-nitriding furnace that produces uniform work from load to load and to each piece within the load has been developed by Pacific Scientific Co., Bell Gardens, Calif. Designed especially for precision control of both atmosphere and temperature, it may also be used for all types of general heat treating work at temperatures to 1850° F.

Triples Capacity—The R-S Furnace Co. will triple its present facilities when it moves into its new plant at North Wales, Pa.

New Firm—Hooker Electrochemical Co. and Foote Mineral Co. have formed a corporation, to be known as HEF, Inc., which will specialize in the manufacture of components of solid fuels for rockets and guided missiles, specifically ammonium perchlorate and other perchlorates.

Chicago Hears Talk on Toolsteels

Past President George Roberts, Vice-President, Technology, Vanadium-Alloys Steel Co., Spoke on "Properties of Alloy Toolsteels" at a Meeting in Chicago. He used slides to demonstrate the properties of steel, stressing the effects of alloy composition and the relationship of strength and ductility in ultra high strength steels. He discussed the properties of high-speed steels, indicating by means of graphs how varying percentages of alloys in these steels could increase wear resistance, machining properties and high-temperature strength. Shown are, from left: B. S. Myers, chairman; Dr. Roberts; W. Wilson, vice-chairman; and E. Pavesic, technical chairman of the meeting. (Reported by H. Fredrick)

Covers Furnace Design Fundamentals

W. A. Darrah (Right), President, Continental Industrial Engineers, Inc., Spoke on "Selection of Furnace Design for Metallurgical Operations" at a Meeting in St. Louis. He is shown with R. D. Bardes, chapter chairman

Speaker: W. A. Darrah

Continental Industrial Engineers, Inc.

W. A. Darrah, president of Continental Industrial Engineers, Inc., presented a discussion on the "Selection of Furnace Design for Metallurgical Operations" at **St. Louis.**

The prosaic furnace doing its job day in and out became a creature of mechanical, chemical, metallurgical and electrical engineering as the evening progressed. One of the most important factors controlling the selection of a furnace design is the required time-temperature cycle and its relation to hourly production. The type of materials handling is a second important factor. Finally, the necessity for a specially controlled atmosphere imposes other limitations on design and, obviously, the size-shape nature and characteristics of the material being processed exert an important influence on design.

Mr. Darrah covered the eight basic designs of furnaces as regards materials handling. Annealing, hardening, carburizing and nitriding are some of the special functions performed by furnaces.

The talk was concluded with the presentation of some "rule of thumb" constants for furnace design. Factors covering rate of heating, capacity of furnace and influence of type of heating were covered. The influence of rate of cooling on furnace design as affected by the permissible temperature at which the work may leave the furnace was emphasized.—**Reported by G. Ansel for St. Louis.**

Defines Solidification At Long Island Meeting

Speaker: W. S. Pellini

Naval Research Laboratory

The hearty souls who braved Long Island's worst snow storm in years were amply rewarded by an excellent talk on "Solidification" by William S. Pellini, superintendent of the Metallurgy Division of the Naval Research Laboratory. Mr. Pellini is well known for his outstanding work on brittle failures in weldments as well as his work on solidification.

Mr. Pellini described the thermal analysis method for investigating the mechanism of solidification of metals. This method involves the use of thermocouples spaced through the section of the solidifying metal. The cooling curve data obtained for these various spatial positions are used to establish the timing of the start and completion of solidification at various distances from the mold wall. These studies have shown that solidification of all metals proceeds in a wave-like fashion by the travel of "start" and "end" of freeze waves across the section from surface to thermal center. For any given metal, the thermal characteristics of the mold walls determine the rate and mode of travel of these waves. For example, in the case of steel, chill walls which remove heat at high rates result in the travel of these waves in conjunction and with narrow distance separation thus resulting in a "narrow band" or progressive solidification. Conversely, sand walls which extract heat at relatively low rates (low heat diffusivity) result in the travel of the start of freeze wave to the center before the end of freeze wave begins its travel from the surface. This mechanism of separate travel of the two waves results in a "broad band" or general solidification mode.

Mr. Pellini further explained that the thermal characteristics of the solidifying metal also affect the relative movement of the two waves. Metals which have high thermal conductivity and broad liquidus to solidus temperature ranges tend to develop very "mushy" or broad band freezing even with molds of relatively high heat diffusivities. He demonstrated these relationships for a wide variety of metals and explained that it is possible to predict the solidification mechanism of metals from considerations of their thermal constants, phase diagram features and the mold wall thermal properties.

With this introduction the speaker proceeded to discuss the effects of shape on freezing rates as being determined by the geometric ratio of surface area of heat removal to volume of metal to be solidified. These relationships form the basis for new scientific methods for establishing the size of feeders or risers required for castings. The relationships of freezing mode of a metal to its foundry characteristics were explained. Metals which freeze with wide band solidification are inherently difficult to handle because of the tendency to form dispersed shrinkage resulting from the inherent difficulty of developing adequate feed metal flow in such cases. Metals which freeze in narrow band fashion are relatively easy to handle by the use of risering and feeding range rules.

Final discussion centered on the specific characteristics of steels, bronzes, aluminum alloys, stainless steels and irons.—**Reported by J. A. Mallen for Long Island.**

—METALS FOR A FINER TOMORROW—

New Translation Service Is Added to Literature Review

Arrangements have been made with the British Iron and Steel Institute for publication in the A.S.M. Review of Metal Literature of titles of translations of foreign articles which are available from the Insttiute's new translation service.

The "Cooperative Translation Service" is administered by the Iron and Steel Institute in collaboration with industry and the British Iron and Steel Research Association. Lists of new translations available from the Institute are issued fortnightly and all of these translations will be listed in the Review of Metal Literature starting with the May issue.

The service has been in operation for nearly a year, and a complete list of all translations now available (about 150 as of February 1958) can be had on request. Inquiries, requests for lists and orders for translations should be addressed to the Cooperative Translation Service, The Iron and Steel Institute, 4 Grosvenor Gardens, London, S.W. 1, England. Prices of individual translations are shown in the listings in the Review of Metal Literature.

The Review of Metal Literature also includes translations available from sources in this country, such as Henry Brutcher, Consultants Bureau, and the American Institute of Physics.

Cites Advantages of Vacuum Melting

F. M. Darmara, General Manager of the Metals Division, Utica Drop Forge and Tool Co., Spoke on "Metallurgical Reasons for Vacuum Induction Melting" at a Meeting of the San Fernando Valley Chapter. Shown are, from left: Dick Frohmberg, vice-chairman; Dr. Darmara; and D. Roda, chairman

Speaker: **F. M. Darmara**
Utica Drop Forge & Tool Co.

F. M. Darmara, general manager of the Metals Division, Utica Drop Forge and Tool Co., spoke at **San Fernando Valley** on "Metallurgical Reasons for Vacuum Induction Melting."

He pointed out that the principal advantage of induction melting lies in the fact that the metallurgist can closely control the actual compositions and hence, the reaction kinetics. This applies to the slag reaction of the melt and response to thermal treatments of the alloy itself. The advantage of vacuum melting in removing gases is only a part of the value of this process.

An example was cited in which it was possible to very closely control and vary for study a single element. This was exemplified by the effects of very small quantities of boron in "Waspalloy". There are many alloy systems in metallurgy in which a strong dependence on minute quantities of solute has been demonstrated, but is not thoroughly understood. Vacuum melting is a powerful tool capable of clarifying certain obscure behaviors.

The economic picture is continually changing in favor of vacuum melting processes. The practice of selecting heats for specialized applications on the basis of certain mechanical or physical properties without understanding the metallurgy will shortly become economically unprofitable as the demand for specialty materials increases. It is evident that although it is perhaps at the moment expensive, vacuum melting, with a precise understanding of reaction kinetics, will permit the production of heats to tailored specification with certainty and obviate the necessity of having to use certain heats for specialized applications.

The meeting was well attended and strong interest was evidenced by the fact that the question and answer period was longer than the talk itself.—**Reported by R. P. Frohmberg for San Fernando Valley.**

Stainless Steel in the Home Topic at Ft. Wayne

Speaker: Edward A. Kister
Allegheny Ludlum Steel Corp.

The annual Ladies' Night meeting of the **Fort Wayne Chapter** featured a talk by Edward A. Kister, development manager of the architectural applications section, Allegheny Ludlum Steel Corp., on "Stainless Steel for Domestic Use".

Mr. Kister outlined the advantages of strength and beauty which stainless steel has for many domestic applications. He pointed out that the women, to a large degree, have fostered the great demand for stainless steel and as a result the stainless industry owes a lot to them because of this boost. He continued by pointing out some of the uses of stainless in flatware, cookware, hardware, appliances, sporting goods, automotive trim, etc.

Generally, in the home the stainless industry has been aimed primarily at the women; however, now they are aiming at the men. With the do-it-yourself trend, stainless, because of its lower maintenance need, is appealing to the men for storm doors, screens, awnings, etc.

The future looks bright, according to Mr. Kister, in the building industry, particularly in view of availability of rolled formed window sections and builders hardware. Color has been a deterrent but blackened stainless steel is available for narrow trim components.

Some of the uses of stainless steel behind the scenes, such as in surgical equipment, pharmaceutical processing equipment, food machinery, etc., were shown in Allegheny's new movie called "The Shining Heart" which preceded Mr. Kister's talk.

A set of stainless tableware was awarded as a door prize and each lady present was given a stainless kitchen utensil.—**Reported by N. L. McClymonds for Fort Wayne.**

New Films

How Metals Behave

A 30-min. color film produced for the American Society for Metals and the American Society for Metals Foundation for Education and Research, based on a series of films prepared by the faculty of Massachusetts Institute of Technology for presentation to the high-school students of Boston and vicinity. It is a simple, straightforward film that makes both the student and the layman more aware of metals and their wide application. It shows the part that metallurgists play in modifying and adapting metals to practical use. Write A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, for further information.

National Officers Visit Cincinnati

National President G. M. Young, Technical Director of the Aluminum Co. of Canada, Ltd., Presented a Talk on the "Extrusion Process", and National Secretary W. H. Eisenman Gave a Report on Headquarters Activities at a Meeting Held by the Cincinnati Chapter. Shown with Mr. Young, fourth from left, and Mr. Eisenman, third from right, are officers and committee members of the Chapter. (Reported by R. L. Bockstiegel for Cincinnati)

Quarterly preprint list

Order Papers by Number
Address Requests to:

Box PP, A.S.M.
7301 Euclid Avenue
Cleveland 3, Ohio

The following papers will be preprinted for distribution to members of the American Society for Metals upon request. Order the papers by their numbers.

The five papers herewith listed represent the 1958 first quarterly preprinting of papers accepted by the Transactions Committee for inclusion in the annual volume of the Transactions of the Society. A brief abstract of each paper in included.

76. Contribution to the Hardenability Problem in Titanium Alloys, by R. P. Elliott and W. Rostoker, Metals Research Department, Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill.

Analysis of cooling curves of unalloyed titanium and two alloys containing 5 and 20%, respectively, demonstrates that thermal diffusivity cannot be considered constant for all alloys. Two methods are described which permit the determination of thermal diffusivity, a, and quench severity, H, from quenching experiments. Some characteristic values of a and H are given.

77. Growth Conditions for Equiaxed Crystals in Aluminum-Magnesium Alloys, by T. S. Plaskett and W. C. Winegard, Department of Metallurgical Engineering, University of Toronto, Toronto, Canada.

The breakdown from columnar growth to equiaxed growth for Al-Mg alloys was found to be dependent upon the rate of solidification (R), the temperature gradient in the liquid ahead of the solid-liquid interface (G), and the solute concentration (Co). It is suggested that constitutional supercooling ahead of the dendritic interface promotes nucleation in the melt.

78. Solubility of Hydrogen in Magnesium, by J. Koeneman and A. G. Metcalfe, Metals Research Department, Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill.

The solubility of hydrogen in magnesium between 550 and 775°C. has been determined using a modified Sieverts apparatus. The magnesium is contained in a thin-walled envelope of iron to prevent evaporation and consequent attack on the silica tube. It has been shown that small pressure differences develop across the iron envelope; these have been measured and used to correct the solubility readings to 1 atmosphere pressure. The corrected solubilities in cc. of hydrogen per 100 gm. of magnesium are 31 at 640° C.; 46.5 at 675° C.; 60 at 725° C.; and 63 at 775° C.

79. Aging Characteristics of Hastelloy B, by R. E. Clausing, P. Patriarca and W. D. Manly, Metallurgy Division, Oak Ridge National Laboratory, Tenn.

The aging characteristics of Hastelloy B were studied in the temperature range from 1100 through 1650° F. for periods from 100 to 1000 hr. Microstructures are shown and hardness data reported. Short time tensile data were obtained both at room temperature and at the temperature of aging and are co-related to the microstructure.

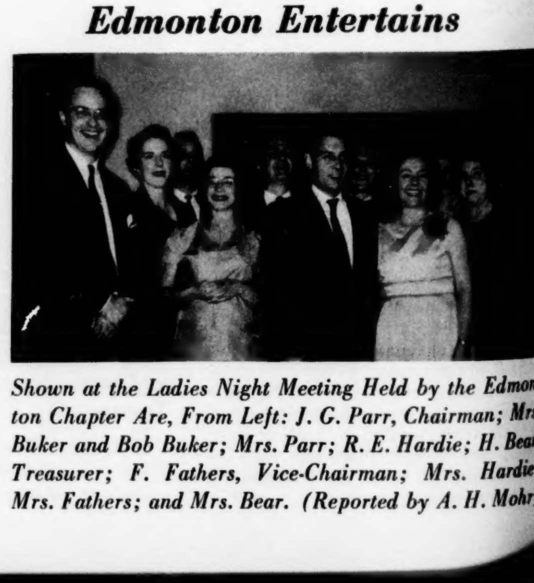
Precipitation occurs at all of the temperatures investigated. At 1000° F. the precipitation is evident through changes in hardness and mechanical property data. At 1300° F., a Widmanstatten precipitate develops rapidly causing a marked increase in hardness and a significant decrease in the tensile ductility. The Widmanstatten precipitate persists at 1400° F. although somewhat coarsened. A needle-like precipitate replaces the Widmanstatten precipitate at 1500° F. and appears at temperatures up to 1650° F., the highest investigated. This latter precipitate appeared to be much less damaging to the tensile ductility than the Widmanstatten precipitate developed at 1300° F.

80. Spiral Growth During Vapor Deposition of Cadmium, by W. I. Pollock, Research Metallurgist, Pigments Department, Experimental Station, E. I. du Pont de Nemours & Co., Wilmington, Del., and R. F. Mehl, Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa.

The macroscopic spiral growth of cadmium upon the basal hexagonal planes of cadmium has been observed and studied during actual deposition from cadmium vapor. These spirals, visible at 75X and having heights between 300 and 2000A., originated at ridge boundaries of crystals grown on substrates formed by melting and then freezing deposits of cadmium which had been previously sublimed from the vapor phase. Even in this case, most growth was by means of layer formation.

A sequence of photographs illustrating the stages of development and growth of these macroscopic spirals has revealed the formation of the initial step, which thereafter grows spirally. Many unresolvable steps of small height emanating from the center of the spiral can aggregate into steps of large height, which are visible some distance from the center of the spiral. Conversely, steps can dissociate into smaller steps during growth.

Edmonton Entertains



Shown at the Ladies Night Meeting Held by the Edmonton Chapter Are, From Left: J. G. Parr, Chairman; Mrs. Buker and Bob Buker; Mrs. Parr; R. E. Hardie; H. Bear, Treasurer; F. Fathers, Vice-Chairman; Mrs. Hardie; Mrs. Fathers; and Mrs. Bear. (Reported by A. H. Mohr)

Meet Your Chapter Chairman

ROCKY MOUNTAIN

JAMES P. BLACKLEDGE, head of the metallurgy division of the Denver Research Institute, supervises all metallurgical research undertaken by the University of Denver for the Department of Defense and private industry.

Jim is a native of Council Grove, Kan. His degrees, B.S. in chemical engineering and M.S. in metallurgy, were obtained from the University of Utah, and he is presently a candidate for Sc.D. in metallurgy at the Colorado School of Mines.

All his previous work has been in research, as research engineer on arc melting of nonferrous slags, magnesium alloys, and project supervisor on low melting alloys.

Mr. Blackledge has been vice-chairman and a member of the executive board of his Chapter. He is a member of other technical societies as well as being active in University clubs. During World War II he served as bombardier-navigator in the continental United States, and is now a major in the U. S. Air Force Reserve.

He and his wife Jean have two daughters, Janice 14, Julie 9, and a son, James Franklin, 7 years old. His hobby is jewelry making and gem cutting.

SYRACUSE

JAMES O. OCHSNER is a native of Syracuse. His B.S. degree in chemistry was acquired at Clarkson College of Technology at Potsdam, where he was active in football and inter-fraternity sports. He worked through such jobs as laborer in the Syracuse Department of Public Works, mail clerk and control chemist with General Chemical Co., Buffalo, before joining Crouse Hinds Co., where he has been foundry metallurgist for the past 18 years.

Mr. Ochsner has been chapter secretary and vice-chairman, and is also active in other technical societies. For the past five years he has been instructor in metallurgy in the evening division of Smith Technical High School.

Jim's recreational interests include trout fishing and music. He is the bass in his church quartet.

LOS ANGELES

JOHN E. WILSON was born in Windsor, N. S., Canada, but is now a U. S. citizen. He holds the degrees of B.S., Wayne University, and M.S., Michigan State University.

After John finished college he joined Great Lakes Steel Corp. as metal finisher and technician, later going to Climax Molybdenum Co. as metallurgist and metallurgical engineer. He is now district manager for Climax in Los Angeles.

Mr. Wilson has presented talks before most of the West Coast chapters, has participated in all Western Metallurgical Congresses since 1936, and accepted the invitation to serve as American Conferee at the 2nd World Metallurgical Congress in Chicago last year. He has held subordinate offices in the Chapter and is actively interested in several other technical societies in Southern California. During World War II he served on the Cast Tank Armor Committee.

He and his wife are interested in photography and enjoy many things such as swimming, but both claim that the lack of time does not let them pursue these interests actively.

ALBUQUERQUE

DOUGLAS W. BALLARD, born in Selma, Ala., attended Alabama Polytechnic Institute, College of the City of New York, Case Institute of Technology, and has a M.S. degre in mechanical engineering from the University of New Mexico.

He served in the army as a member of the Special Engineer Detachment, Manhattan Engineering District and Los Alamos Scientific Laboratory, as well as process engineer for Tennessee Eastman at their Y-12 Electromagnetc Separation Plant. Upon discharge, he returned to Los Alamos as supervisor of plutonium fabrication and inspection.

For a time he was plant manager at the Ames Co., in Cleveland, Ohio, before joining Sandia Corp. as staff member, and is now division supervisor, Product Evaluation and Standards Division, where all new items of atomic ordnance are tested prior to release for full production.

Mr. Ballard is a member of several technical societies, and author of a number of papers on testing and evaluation techniques.

Douglas and his wife have a daughter, 4, and a son, 2½ years old.

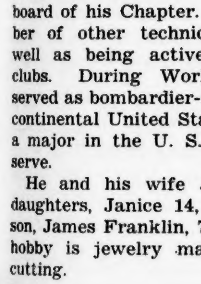
EDMONTON

JAMES GORDAN PARR, now professor of metallurgy, University of Alberta, was born in Peterborough, England, and is an honor graduate of Leeds University with a B.Sc. degree in metallurgy. He also has a Ph.D. from Liverpool University. Before taking his present position he served as lecturer in metallurgy at the University of Liverpool, and research associate at British Columbia.

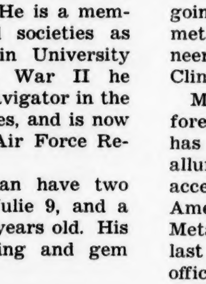
Since 1948 Jim has been engaged in research on the structure and properties of alloys, and is currently concerned with titanium alloys at the University, directing a project involving seven post-graduate students.

Previous activities for A.S.M. include serving on the executive and educational committees of the Vancouver Chapter, and vice-chairman of the Edmonton Chapter. He was a conferee at the 2nd World Metallurgical Congress held last year.

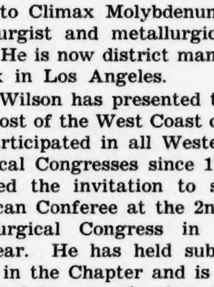
As a sideline Jim does broadcasting and writes plays for the Canadian Broadcasting Corp., which leaves him with very little spare time. He is married and has a boy and girl.



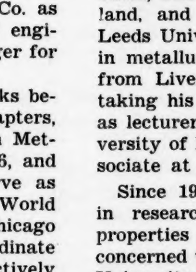
J. E. Wilson



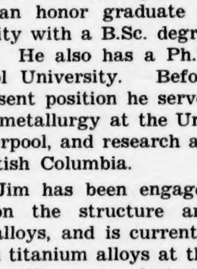
D. W. Ballard



J. P. Blackledge



J. O. Ochsner



J. G. Parr

CHAPTER MEETING CALENDAR

Albuquerque	**May 15**		**C. B. Robine, Jr.**	Flame Plating
Boston	**May 2**	M.I.T. Faculty Club	**Rev. Daniel Linehan**	The Antarctic
British Columbia	**May 7**	Peace Portal Golf Club	**Social**	Golf Tournament
Calumet	**May 13**	Phil Smidt's	**H. J. Hansen, Jr.**	Surface Characteristics of Flat-Rolled Products
Canton-Massillon	**May 13**	Mergis Restaurant	**W. Steurer**	Metallurgical Aspects of Guided Missiles
Carolinas	**May 15**	Salisbury	**Q. D. Mehrkan**	Salt Bath Brazing
Cedar Rapids	**May 13**	Roosevelt Hotel		Temperature Measurement and Control
Chicago	**May 9**		**Social**	Ladies Night
Cincinnati	**May 8**	Engineering Society	**Business**	Annual Meeting
Cleveland	**May 5**	Hotel Manger	**Social**	Ladies Night
Columbus	**May 7**	Broad St. Church	**S. J. Whalen**	High-Temperature Brazing Alloys
Dayton	**May 22**	Walnut Grove Country Club	**Business-Social**	Annual Meeting and Outing
Delaware Valley	**May 21**		**A. V. Feigenbaum**	Quality Control
Detroit	**May 12**		**John King**	Cold Extrusion
Eastern New York	**May 13**	Panetta's	**Social**	House of Magic, Ladies Night
Golden Gate	**May**	Monterey		Seminar and Social
Hartford	**May**		**Social**	Annual Outing
Indianapolis	**May 19**	Village Inn	**A. W. F. Green**	Temperature Behavior Including the Cryogenic Field
Kansas City	**May**		**Social**	Spring Party
Los Angeles	**May 25**	Rodger Young Auditorium	**M. Lauderback**	Oxygen Process for Making Steel
Milwaukee	**May 9**	City Club	**Social**	Party
Minnesota	**May 28**	Calhoun Beach Club	**R. E. Crump**	Dry Lubricants
Montreal	**May 5**	Queen's Hotel	**Business-Social**	Annual Meeting and Ladies Night
Muncie	**May 13**	Ball State Students Center	**Social**	Ladies Night
New Jersey	**May 19**	Essex House	**G. R. Seidel**	Research and You
New York	**May 5**	Brass Rail	**W. Steurer**	Guided Missiles—Material Requirements
Northeast Pennsylvania	**May 9**	Irem Temple Club	**Business**	Annual Meeting
Notre Dame	**May 14**	Eddie's Restaurant	**J. C. Fisher**	Magnetism and Magnetic Materials
Oak Ridge	**May 21**		**H. B. Hurt**	Psychology of Engineers
Ottawa Valley	**May 6**	Mines Branch	**J. S. Fuller**	Where Precious Metals Are Used
Peoria	**May 12**	American Legion	**J. F. Victory**	Problems of High-Speed Flight
Philadelphia	**May 8**	Engineers Club	**D. S. Clark**	Initiation of Brittle Fracture
Philadelphia-Jr. Section	**May 8**	Engineers Club	**D. S. Clark**	Joint Meeting With Philadelphia
Pittsburgh	**May 8**	Gateway Plaza	**H. B. Emerick**	Role of High-Purity Oxygen in Metallurgical Processes
Richmond	**May 21**	Holloway House	**N. Grant**	Russian Metallurgy
Rochester	**May 11**	Elk's Club	**Business**	Annual Meeting
Rockford	**May 21**	Faust Hotel	**J. D. Graham**	Field Failures as Influenced by Heat Treatment and Machining
Rome	**May 5**	Trinkus Manor	**David Lilly**	Metallurgical Problems of Atomic Energy
Saginaw Valley	**May 24**	Rolling Green Country Club	**Social**	Dinner-Dance
St. Louis	**May 9**	Congress Hotel	**G. M. Young**	Aluminum Alloy Development
Savannah River	**May 8**	Timmerman's Lodge	**J. J. Corr**	Crime Detection
Syracuse	**May 17**	Hinerwadel's Grove	**Social**	Clambake
Texas	**May 6**	Ben Milam Hotel	**G. M. Young**	Aluminum
Tri-City	**May 13**	American Legion	**J. L. Montgomery**	Electrical Discharge Machining
Utah	**May**	New House Hotel	**H. R. Neifert**	Why Materials Fail
Washington	**May 12**	Arlington Towers		
West Michigan	**May 19**	Schnitzelbank Restaurant	**G. M. Young**	Extrusion Process
Wichita	**May 13**	K of C Hall	**B. W. Gonser**	Uncommon Metals—Metal Coatings Other Than Electrolytic
Wilmington	**May 14**	Powder Mill	**Panel**	Metal Cleaning
Worcester	**May 14**	Wachusett Country Club	**Social**	Dinner-Dance
York	**May 12**			

May 12 **Tri-State Meeting Baltimore, York and Washington Chapters in Washington**

May 8 **Northeastern Ohio Regional Meeting Cleveland**

May 9 **New England Regional Meeting .. Boston, Hartford, New Haven, Rhode Island, Springfield and Worcester, in Springfield**

Regional Meeting Set For May in Washington

The **Washington, Baltimore** and **York Chapters** are sponsoring a Regional Meeting, to be held in Washington, D. C., on May 19, 1958. The schedule of meetings and activities of this meeting is as follows:

Morning

National Bureau of Standards (East Lecture Room, East Bldg.)
Technical Chairman: Jules Simmons, U. S. Atomic Energy Commission

10:00 a.m.—Power Applications of Atomic Energy, by Clark Goodman, Assistant Director for Technical Operations, Division of Reactor Development, U. S. Atomic Energy Commission.

10:40 a.m.—Materials Problems in Nuclear Reactors, by Henry Hausner, Nuclear Energy Consultant, New York.

11:40 a.m.—Radiation Effects on Materials, by William A. Maxwell, Chief, Materials Section, Nuclear Division, Martin Aircraft Co.

Afternoon

1:00 p.m.—Field Trip to Naval Research Laboratory Reactor (bus transportation furnished).

2:00 p.m.—Lunch at NRL Cafeteria.

3:00 p.m.—Tour of the Reactor.

5:00 p.m.—Buses return to Arlington Towers, Arlington, Va.

Evening

Chairman: Henry Stauss, U. S. Naval Research Laboratory; Technical Chairman; Jules Simmons, U. S. Atomic Energy Commission

5:30 p.m.—Fellowship Hour.

6:30 p.m.—Dinner.

8:00 p.m.—The Metallurgist, A.S.M. and the Metals Industry, by Arthur E. Focke, Past-President A.S.M., and Manager, Materials Division, Atomic Energy Division, General Electric Co. Election and Installation of Washington Chapter Officers.

9:45 p.m.—Buses return to National Bureau of Standards.

General chairman of the meeting is N. C. Fick, Allied Kennecott Titanium Corp. Additional information and advance registration possible by writing to Mr. Fick at 836 24th St., South, Arlington, Va.

—METALS FOR MANKIND—

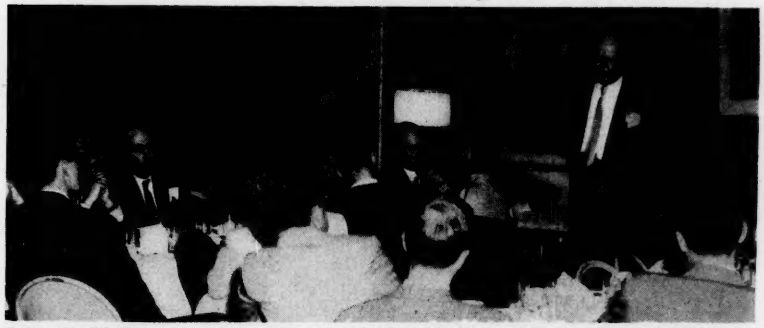
Talks on Nonferrous Metals

Speaker: F. W. Kallam

Ferrous Alloys & Electrodes

F. W. Kellam, sales manager of Ferrous Alloys & Electrodes, a division of Union Carbide Ltd., presented a talk on "The Application of Nonferrous Metals in the Iron and Steel Industry" at a meeting held by the **Edmonton Chapter**. The meeting enjoyed a large turnout and was considered very successful.—**Reported by A. H. Mohr for Edmonton.**

Talks on Atomic Uses of Aluminum



John T. McCormack, Reynolds Metals Co., Is Shown Delivering His Talk on "Applications of Aluminum in Atomic Reactors, Guided Missiles and Modern Aircraft" at a Meeting Which Was Held Recently by the Carolinas Chapter

Speaker: John T. McCormack

Reynolds Metals Co.

Ten years ago there was no controlled nuclear energy — atomic bombs, yes, but they can scarcely be classed as controlled power. Now we have orderly controlled generation of heat or electricity from this source as well as controlled energy for irradiation and a number of other interesting things. This has become possible through knowledge of fission reactions and mechanisms and materials of construction.

Aluminum is used for building reactors as it is not damaged by radiation, it is available in quantity and we know how to fabricate it. It is used for structural parts, for fuel element containment, as a component of fuel elements, in shielding and in reactor containment vessels.

In the fuel elements it is necessary that fissionable materials be positioned with a high degree of accuracy and this can be done by "canning" the fuel in aluminum. In some instances these aluminum cans are placed in aluminum racks to get the desired geometric pattern and spatial relations; on occasions there are channels in the graphite pile which position the fuel elements. In water-moderated reactors the containment vessel is often aluminum as it has sufficient mechanical strength, corrosion resistance and is economical.

Aluminum is not damaged by radiation, and in some instances it seems to benefit from radiation. This is probably caused by the rearrangement of the molecular structure and the elimination of dislocations and other lattice imperfections. Some alloys, as those containing manganese, cobalt, copper and chromium, cannot be used in reactors because they absorb fission products and become radioactive. On the other hand, the absorption cross section of magnesium and silicon are very small and these are common alloying elements for reactor construction.

Fuel elements consist of uranium, natural or enriched, or plutonium, assembled in such mass and such configuration that fission, with the attendant production of a considerable amount of heat, occurs at a controlled rate. In making fuel elements one technique is to pressure weld a strip of uranium to a strip of aluminum and then clip "coupons", small pieces of the desired size, from the bi-metallic strip. These are assembled in a suitable rack, usually aluminum, and enclosed in an aluminum can. Zirconium can be used instead of aluminum, and in a number of instances is, but it costs more than 40 times as much. Zirconium is better than aluminum, but there are serious doubts that it is 40 times better, and it is not nearly as available. In another technique, aluminum and zirconium powders are mixed, passed between rolls and the resulting green compact is sintered and rerolled to form "meat" for fuel elements. Aluminum adjusts to the volume change which takes place in the burn-up of atomic fuel with greater facility than any other material.

For shielding material, boral, a mixture of boron carbide and aluminum, is very effective and, on a weight basis, probably the most effective. It is made by melting aluminum metal and stirring boron carbide powder into it, casting and rolling a little. A much more uniform material has been made by mixing boron carbide powder and aluminum powder and rolling and sintering.

In missiles, aluminum finds application in the airframe, mechanical parts and as part of the fuel. There is a strong trend away from corrosive liquid propellants to solids and aluminum powder is one of the components of the best of these.

In modern aircraft which fly at supersonic speeds we need materials which keep much of their low-temperature strength and we are making aluminum alloys which fill this requirement. We are also making aluminum-ceramic compounds which meet these requirements and which may be useful in other fields.—**Reported by P. Stalder for Carolinas.**

Reviews Metallurgical Educational Requirements

R. Schuhmann, Jr. (Right), Purdue University, Who Presented a Talk on "Metallurgical Education", Is Shown With Arthur Backensto, Technical Chairman, at a Meeting Held by the Eastern New York Chapter

R. M. Parke (Left), Research Laboratory, The Knolls, General Electric Co., Is Shown as He Accepts a 25-Year Membership Certificate From A. A. Burr, Chairman of Eastern New York Chapter at the Same Meeting

Speaker: R. Schuhmann, Jr.
Purdue University

"Metallurgical Education" was the subject of a talk given by Reinhardt Schuhmann, Jr., before the **Eastern New York Chapter.**

Dr. Schuhmann outlined a four-year engineering curriculum based on a model presented by the American Society for Engineering Education in its "Report on Evaluation of Engineering Education". He then proceeded to introduce and discuss the course work which he felt was necessary to develop a well-rounded metallurgical engineer.

Industry's rush on engineering students points up the following general conclusions on engineering education: One B.S. degree is as good as another; it is important to be a well-rounded individual; and one can usually do graduate work at night while working in industry during the day.

The speaker pointed out that there should be five main areas of study in any engineering curriculum. They include: humanistic and social sciences; math and basic science; engineering sciences; engineering analysis (design); and options and electives. With respect to metallurgical engineering, the undergraduate program should be broad enough and serve equally the interests of students who intend to go to graduate school and those who expect to go into industry. With the foregoing assumption kept in mind, a metallurgical program should be built around the following areas of applied science (in order of importance): nature and properties of materials; thermodynamics; transfer and rate mechanism; mechanics of solids; electrical theory; and fluid mechanics. There should be no reduction in the time spent in the laboratory. An increase in math for the metallurgists would be beneficial. Process metallurgy would be introduced in the program as examples for basic theory.—**Reported by Louis Ianiello for Eastern New York.**

Explains Nuclear Energy Applications at Warren

Speaker: D. W. Steel
Case Institute of Technology

"Nuclear Energy and Industrial Applications" was the subject of a talk given by D. W. Steel, director of nuclear study projects, Case Institute of Technology, at **Warren.**

When U_{235} is bombarded by controlled slow neutrons the nuclei of the U_{235} undergoes fission. During this process fission fragments are given off along with fast neutrons. It is assumed that there are usually three neutrons produced in fission and that of these, one carries on the fission chain with U_{235}, one is captured by U_{235} and the third is lost, either in other forms of nonfission capture or by escape from the system. However, inserted into the system are moderators which gather in the fast-moving neutrons produced in fission and slows them down to the necessary speed to be used in the bombardment of other U_{235}. Usually only one neutron coming out of the moderator is used to bombard another U_{235}, one neutron may escape the system, and the third is captured by U_{238}, which then decays to Np_{239} and then to Pu_{239}. During the fission process enormous quantities of energy are released, of which the major portion is in the form of heat. Suppose in a given reactor we cause the fission of one kilogram of U_{235} to take place in any given day. This fission will release about a million kilowatts of power, of which most of the energy will be released as heat. If this reactor is designed to produce Pu_{239}, through the capturing of nonfission neutrons by U_{238}, then one kilogram of U_{235} per day will result in the formation of one kilogram of Pu_{239} and the liberation of about a million kilowatts of power, mostly as heat.

Mr. Steel described the heterogeneous reactor, starting with the construction of the core. The uranium is enclosed in an aluminum shell so that no water comes in contact with it. At the same time the aluminum shell will permit the passage of neutrons so that the fission reaction can proceed.

The core is usually composed of 25 units, 21 are the uranium-aluminum rods and 4 are control rods. The control rods are composed of either boron or hafnium, which have great neutron absorption powers, and will control the reaction by absorbing neutrons. The core is completely surrounded by a beryllium case to deflect any stray neutrons back into the core. Water is then pumped through the reactor. This serves to cool the core and at the same time turns water to steam. The steam is taken off to run a turbine, from the turbine the steam is sent through a condenser and then back to the reactor. Usable energy, in the form of electricity, is then produced by the turbine. However, most of the reactors under construction today are for propulsion rather than for electrical energy.

Mr. Steel mentioned that the atomic industry, as it is known today, falls into two classifications—bombs and peaceful or industrial. At present the bomb business is four times as large as the industrial; each year about three billion dollars is spent for all atomic uses, of which approximately one-half billion dollars goes into peaceful or industrial applications.—**Reported by T. P. LaVelle for Warren Chapter.**

IMPORTANT MEETINGS *for May*

May 1-8—American Society of Tool Engineers. Tool Show and Annual Meeting, Convention Center and Ben Franklin Hotel, Philadelphia. (H. E. Conrad, Executive Secretary, 10700 Puritan Ave., Detroit 21)

May 5-6—American Institute of Mining, Metallurgical and Petroleum Engineers. Conference on Properties of High-Strength Steels, Penn-Sheraton Hotel, Pittsburgh. (Ernest Kirkendall, Secretary, 29 W. 39th St., New York 18)

May 8-9—Refractories Institute. Annual Meeting, Homestead, Hot Springs, Va. (Avery C. Newton, Secretary, 1801 First National Bank Bldg., Pittsburgh 22)

May 11-14—Copper and Brass Research Association. Annual Meeting, Homestead, Hot Springs, Va. (T. E. Veltfort, Managing Director, 420 Lexington Ave., New York 17)

May 12-16 — American Society for Metals. Southwestern Metal Congress and Exposition, Automobile Bldg., State Fair Park, Dallas. (W. H. Eisenman, Secretary, 7301 Euclid Ave., Cleveland 3)

May 13-15—Investment Casting Institute. Spring Meeting, Edgewater Beach Hotel, Chicago. (H. P. Dolan, Executive Secretary, 27 E. Monroe St., Chicago 3)

May 14-16—Society for Experimental Stress Analysis. Spring Meeting, Hotel Manger, Cleveland. (W. M. Murray, Secretary-Treasurer, P. O. Box 168, Cambridge 39, Mass.)

May 18-21—Industrial Heating Equipment Association. Semi-Annual Meeting, Homestead, Hot Springs, Va. (R. E. Fleming, Executive Vice-President, Associations Bldg., Washington 6, D. C.)

May 19-21—National Association of Metal Finishers. Annual Meeting, Sheraton-Gibson Hotel, Cincinnati, Ohio. (P. P. Kovatis, Executive Secretary, 60 Bentley Rd., Cedar Grove, N. J.)

May 19-21—Nonferrous Founders Society. Annual Meeting, Hotel Carter, Cleveland. (George S. Rose, Secretary, 150 E. 42nd St., New York 17)

May 19-22—American Electroplaters Society. Annual Meeting, Sheraton-Gibson Hotel, Cincinnati, Ohio. (J. P. Nichols, Secretary, 445 Broad St., Newark 2, N. J.)

May 19-23—American Foundrymen's Society. Annual Castings Congress and Show, Public Auditorium, Cleveland. (W. W. Maloney, General Manager, Golf and Wolf Rds., Des Plaines, Ill.)

May 26-28 — American Society for Quality Control. Annual Meeting, Statler Hotel, Boston. (W. P. Youngclaus, Jr., Secretary, 161 W. Wisconsin Ave., Milwaukee 3)

Chattanooga Entertains Its Ladies

The Chattanooga Chapter Entertained Its Ladies at a Recent Meeting During Which Robert J. T. Emond, Forester, Hiwassee Land Co., Spoke. Shown are, from left: Mr. and Mrs. Emond; Mr. and Mrs. John Pikcunias; and Mr. and Mrs. Charles Pandelis. A special entertainment was also presented

Speaker: Robert J. T. Emond
Hiwassee Land Co.

The **Chattanooga Chapter** observed Ladies' Night with a special program which was arranged to be of interest to both ladies and gentlemen. The speaker was Robert Emond, forester of the Hiwassee Land Co., the land management company for the Bowaters-Southern Paper Corp. His talk was prefaced by a color picture showing the conversion of pulp wood to paper at the Bowaters plant.

The Bowaters Paper Corp. is a British company which specializes in newsprint and serves seven of the ten largest London newspapers and five New York newspapers, as well as many newspapers throughout the United States. Since a large part of its production is used in the South, and the Tennessee Valley supplies abundant electricity for paper manufacture, a good supply of pulp wood and labor and the Tennessee River provides an economical means of transportation, the Bowaters Corp. decided to establish the plant at Calhoun, Tenn. The present production is 300 tons of print per day. This production requires 32 million gal. of water daily.

With this production and future requirements, a supply of pulp wood must be assured. This is the function of the Land Management Co. Mr. Emond described the program of reforestation, protection and advising service to private owners in order to insure this supply. This program is designed to implement those of the states and the Tennessee Valley Authority so as to make farmers conscious of the importance of woods culture as a source of revenue. It instructs them in the best methods of disease and pest control, the importance of thinning out crowded timber, and aids them in reforestation of eroded lands to prevent further erosion and to provide a cash crop.—**Reported by J. H. McMinn for Chattanooga Chapter.**

German Metallurgist Talks At Albuquerque Meeting

Speaker: F. Foerster
Foerster Institute

Frederick Foerster, director of the Foerster Institute, Reutlingen, West Germany, discussed "New Electromagnetic Methods for Nondestructive Testing of Metals" at a meeting held by the **Albuquerque Chapter.**

Dr. Foerster has gained international recognition for his pioneering research in the use of eddy currents for nondestructive testing. In 1940 he became section chief in the physics department of the Kaiser Wilhelm Institute for the study of materials and remained there until after World War II. The Institute was abandoned after the war and the instruments moved to France. In 1949 Dr. Foerster contacted his old coworkers and founded the Dr. Foerster Institute, where research has been focused on the special treatment of electric and magnetic tests methods to study the soundness of materials.

In his talk Dr. Foerster traced the history of early experiments with eddy currents, described some of his recent research, and showed slides illustrating nondestructive testing techniques in German industry. Early research was concerned mainly with broad, basic principles. Present research includes such detailed experiments as the study of a copper bar in a mercury-filled cylinder with an electric coil around the cylinder.

In German industry, nondestructive testing is used extensively to control the quality of such items as automobile parts. Slides taken in the Volkswagen plants showed nondestructive inspection of engine cylinders, valves and other parts.

Dr. Foerster concluded with a discussion of some of the latest nondestructive testing equipment produced in Germany. — **Reported by C. A. Scott for Albuquerque.**

Describes Salt Bath Equipment

Edward N. Case, Ajax Electric Co., Spoke on "Recent Developments in Heat Treating Equipment" at a Meeting of Puget Sound Chapter. Shown are, from left: J. W. Sweet, vice-chairman; Mr. Case; Norman Hart; and Seth Wilson

Speaker: E. N. Case
Ajax Electric Co.

Edward N. Case, sales manager, Ajax Electric Co., presented a talk on "Recent Developments in Heat Treating Equipment" at a meeting of **Puget Sound Chapter.**

He pointed out that the primary purpose for using salt baths is the low distortion produced in the metal part, and he mentioned various reasons for using salt baths for heat treatment of alloys.

Mr. Case noted that some of the advantages of salt baths included long service life, surface protection for the part, elimination of skilled labor and low investment per unit of production. Disadvantages included cost of salt, waste disposal problem and trapping of salts in parts requiring washing.

The speaker discussed salt baths for cyaniding, carburizing, annealing, solution heat treating, cleaning and high-speed toolsteel hardening. He described various types of equipment, including electric heating (either immersion or external), fuel fired furnaces and immersion tube fired heating. Excellent illustrations of practical applications of austempering and dip brazing were shown.—**Reported by J. E. Kamitchis for Puget Sound Chapter.**

—METALS FOR MANKIND—

History of Aircraft in Canada Topic at Montreal

Speaker: John L. Plant
Avro Aircraft Ltd.

Over 200 members and guests attended the **Montreal Chapter's** Executives Night Meeting to hear a talk by Air Vice-Marshal John L. Plant, executive vice-president and general manager, Avro Aircraft Ltd., on the "Development of Aircraft by Canadian Industry".

Mr. Plant presented a survey of the aircraft industry over the past 50 years, covering primarily the design and manufacture of aircraft. He stressed the great strides and expansion of Canadian aircraft factories which are turning out planes second to none and stated that the aircraft industry, at the present time, is the third largest employer of labor in Canada.

Past chairmen of the Chapter present at this meeting included C. F. Pascoe (1927-28), T. C. McConkey (1930-31), B. Collett (1937-38), and R. W. Bartram (1938-39).—**Reported by G. F. Norman for Montreal.**

—SERVICE THROUGH METALS—

Designing Die Castings Is Subject at Syracuse

Speaker: C. Fuehrer
Ainsworth Precision Castings Co.

Members of the **Syracuse Chapter** heard Clarence Fuehrer, Eastern Division sales manager, Ainsworth Precision Castings Co., speak on "Designing for the Use of Die Castings".

Mr. Fuehrer defined die casting as the process of producing accurately dimensioned, sharply defined, smooth surfaced parts by forcing molten metal under pressure into metal dies or molds. Production of die castings has increased year by year because of decreased costs and increased sales appeal. In die casting the low-melting temperature alloys are used. Production requirements should be substantial to amortize die costs.

The design of the casting is of paramount importance. Heavy sections should be avoided if at all possible, as should undercuts and long flat sections. Mr. Fuehrer presented slides showing correct and incorrect die casting design. An interesting film on die casting concluded the program.—**Reported by G. Trojanowski for Syracuse.**

Traces Developments in Stainless Steel at Atlanta

Speaker: F. B. Foley
Pencoyd Steel and Forge Co.

Francis B. Foley, Pencoyd Steel and Forge Co., gave a talk entitled "The Old and New in Stainless Steel" at a meeting of the **Atlantic Chapter.**

Mr. Foley pointed out that stainless steel is any steel which withstands oxidizing agents and corrosive attacks. He traced its history from World War I, pointing out that little stainless was made until after the war, and noting that production increased from 0.1% of total steel production in 1929 to 1.0% in 1955.

Mr. Foley covered the origin and development of martensitic, ferritic and austenitic stainless steels. Various alloying constituents and their effects were discussed, as well as their physical properties and effects of different conditions. He concluded with a survey of the problems and factors which influence the choice of a stainless steel.—**Reported by J. W. Johnson for Atlanta.**

Outlines Materials Needs Of Nuclear Power Reactors

Speaker: A. N. Holden
General Electric Co.

Members of the **San Fernando Valley Chapter** heard A. N. Holden, manager of metallurgy and ceramics at General Electric Co.'s Vallecitos Laboratory on the "Selection of Materials for Nuclear Power Reactors".

The basic fission equation indicating the release of intense nuclear energy was used to show the importance of selecting materials on the basis of favorable resistance to radiation damage. Many other properties were shown to be of importance in the selection of materials for nuclear reactors. Among these were strength, corrosion resistance, neutron cross section, thermal stability, fabricability and reproductibility of quality. Reproductibility of quality from one batch of raw material to another in the production of uranium oxide bodies was obtained, in one instance, by blending many batches.—**Reported by Ed Reed for San Fernando Valley.**

CORRECTION

William A. Mudge, who was appointed to the 1958 Nomination Committee, finds that he is unable to attend the meeting which, according to the Constitution, will be called during the third week of May. William C. Schulte of the New Jersey Chapter has been appointed to act in his place.

Defines Metal-Bearing Fuels at Penn State

Speaker: James Morris
NACA

"Metal-Bearing Fuels" was the subject of a talk given at a meeting of the **Penn State Chapter** by James Morris, head of the Combustion Dynamics Section, National Advisory Committee for Aeronautics.

The most important goal for a new fuel is greater range. The fuel property that has the greatest effect on range is heating value. From elemental heats of combustion, investigators have found that only hydrogen, beryllium, boron and lithium have substantially higher heating values than carbon. Beryllium is very toxic, and both beryllium and lithium are relatively unavailable. This leaves hydrogen, carbon and the metal boron as practical elements for aircraft fuels.

Chemical compounds of carbon and hydrogen have heating values ranging up to 21,500 Btu/lb. Jet fuels, such as JP-4, are cuts of petroleum with heats of combustion up to 19,000 Btu/lb. Boron hydrides have heating values topped by the gas, diborane, at 31,100 Btu/lb. and the liquid, pentaborane, at 29,000 Btu/lb.

Fuel density as well as heating value has an effect on aircraft range, since a given weight of light fuel requires a larger tank volume than does a dense fuel. This increased empty weight of the aircraft means decreased range. This fact led to the study of three relative heating values, Btu/lb., Btu/ft.^{3} and Btu/lb. of air required for stoichiometric burning.

Hydrogen liberates the most energy per pound of fuel and the least energy per cubic foot of fuel. Pentaborane and boron have high values in all three categories.

A boron slurry, pentaborane, and boron were found to give computed ranges from 20 to 40% greater than that for JP-4. This finding was the important gain sought, but other factors had to be investigated.

There are cases where greater thrust is more important than greater range, since an aircraft with long-range potential is of little value if it can't get off the ground. Thrust is a function of the amount of energy released. Both boron and pentaborane, along with magnesium and aluminum, can product greater thrusts than hydrocarbon fuels.

Work with magnesium and aluminum started and several problems became immediately apparent. These problems involved fuel feed methods and the handling of the metal oxides that result from burning.

These fuels were found to perform best in the form of hydrocarbon slurries. Aluminum oxide overdramatized the deposit problem, since it melts in the middle of the temperature range for engine applications. Thus, work on aluminum was discontinued.

Metallic boron was later dropped from consideration due to its poor burning efficiency. Experiments on magnesium slurries showed that they burn more efficiently and yield greater thrust than hydrocarbon fuels. However, they do not possess long-range capabilities.

In summarizing, Mr. Morris said that the boron hydrides now appear to be the most effective of the metal-bearing fuels that can make aircraft fly farther, faster and higher. The metallic oxides formed when these fuels are burned pose problems, but methods for handling B_2O_3 in jet engines are being determined. In addition, the high reactivity that promotes efficient burning, even at high altitudes, is accompanied by safety and handling problems. Thus, the potential of metal-burning fuels for jet aircraft is yet to be fully defined by further research.—**Reported by Richard Heacox for Penn State.**

Editor Warns Against Boondoggles

George F. Sullivan (Right), Editor, Iron Age, *Who Presented a Talk on "What's Ahead for 1958" at a Meeting Which Was Held by the New Jersey Chapter, Is Shown With Stanley G. Lindstrom, Chairman of the Chapter*

Speaker: G. F. Sullivan
Iron Age

There is nothing in the current business outlook that is going to be helped one iota by pushing the panic button, according to G. F. Sullivan, editor of *Iron Age,* who gave a talk, "What's Ahead for 1958" before the **New Jersey Chapter.** A survey of 17 industries that supply the nation's $140-billion metalworking industry show that more than two-thirds of the companies expect 1958 business to be at least as good, if not better than it was in 1957.

But, Mr. Sullivan predicted, countless pressure groups will try to use the Soviet threat as an excuse to spend billions of dollars on boondoggles. The theory that we can cure any evil overnight by spending and spending is as phoney as an "honest" Communist.

And the people who should play a major role in guarding against these billion dollar boondoggles are the nation's scientists, metallurgists and engineers. For this, he asserted, is the era of the engineer and the scientist. Their words will carry weight they never carried before.

That weight should be put behind an intelligent increase of missile production, scientific training, atomic power and a reasonable continuation of planned civilian business expenditures. Throwing Federal money at engineering schools which can't absorb very many more students poses the threat of Federal domination of education.

But research is the cheapest thing on the market today; it's cost is negligible compared to weapons production, and we certainly can afford a lot more than we are getting now.

The speaker called for a sense of urgency in the development of atomic power for export, just as we need more urgency in missile development. He stated that we all should agree that atomic power, which is not urgently needed in the United States, can be developed here by private industry, but that we also should agree that it is urgently needed by much of the free world. So, we should capitalize on exporting our admitted lead in the atomic energy field—this is part of the cold war and therefore calls for government funds.

The sooner we can put up power plants in underdeveloped countries—plants with American equipment and technology—the sooner we can win back the prestige we lost when Sputnik I shot into the skies. Atomic power can be critically important in the battle for the minds of men.

We cannot pretend that we are not in this race; we should go out to win it. — **Reported by R. H. W. Heartel for New Jersey Chapter.**

Describes Hot Oil Marquenching

Shown at a Meeting of North Texas Chapter Are, From Left: Earl Casey, Secretary; A. S. Holbert, Chairman; L. W. Kalinowski, Sinclair Refining Co., Who Spoke on "Hot Oil Marquenching of Aircraft Steel"; and R. C. DeWaal

Speaker: L. W. Kalinowski
Sinclair Refining Co.

Members of the **North Texas Chapter** heard L. W. Kalinowski, staff engineer, Sinclair Refining Co., speak on "Hot Oil Marquenching of Aircraft Steel".

The widespread acceptance of the hot oil quenching process by industry is the outcome of three basic facts: A more complete understanding of this process by the metalworking industry; a large variety of steels employed by aircraft, automotive and farm industries respond very favorably to this method; and recent advancements by heat treaters, metallurgists, furnace designers and petroleum engineers have put this process on a paying basis.—**Reported by J. P. Fowler for North Texas.**

—THE FUTURE IS REFLECTED IN METALS—

Tells How Toolsteels Are Heat Treated at Meeting of Western Michigan Chapter

Speaker: R. H. Boettger
Columbia Tool Steel Co.

Members of the **West Michigan Chapter** heard R. H. Boettger, product application metallurgist, Columbia Tool Steel Co., speak on "Heat Treatment of Toolsteels".

Mr. Boettger's presentation of this particular subject was very comprehensive. Preprinted outlines of his talk were distributed to the audience. Various visual aids such as graphs, photomicrographs and models were effectively used to emphasize certain aspects of the talk.

Mr. Boettger stressed the importance of regarding the treatment of toolsteels as an exact science in contrast with the rather crude methods used in the past. The use of indifferent procedures, inadequate furnace equipment and accessories, and improper or contaminated coolants can result in excessive heat treatment costs and a resultant loss of profits. Using examples to illustrate this point he showed how tool strength can be altered 50% and dimensional accuracy can be varied 30% by a 50° F. temperature range. The added effects of higher hardening temperatures on decarburization and cracking were also emphasized.

The initial portion of the talk dealt with some of the basic fundamentals of the heat treatment of toolsteels. T-T-T curves for several common toolsteels were used to illustrate the variation in structure produced by various treatments. The effect of mass on hardenability was discussed and it was shown that section size can sometimes be overcome by increasing the hardening temperature within a range of 50° F. If satisfactory hardness cannot be obtained in this recommended range, it is advisable to switch to a toolsteel which would develop the specified hardness. Fine-grain steels will generally produce highest toughness. The effect of hardening temperature and time of the hardening temperature on toughness and dimensional change were illustrated. Tempering temperature is particularly important in controlling dimensions.

Mr. Boettger then discussed various aspects of the quenching and tempering operations which affect tool treatment. The importance of tempering immediately after quenching was illustrated by a graph showing the dimensional change in a quenched oil hardening steel with increased time. Maximum movement occurred after 1 hr. and was 0.0002-0.0003 in. Quench cracking and warping can be reduced by the use of hot salt quenching at 1000-1100° F., a delayed quench, hot salt quenching at 400-500° F. and time quenching in hot oil at 150-200° F. Agitation of oil quench baths and the use of brine instead of water are particularly important in eliminating "soft spots".

In summarizing the subject of the heat treatment of toolsteels the speaker gave the following "Ten Rules for Good Tools".

1. Select the best toolsteel for the operation.
2. Design tools to avoid drastic changes in section, sharp corners, re-entrant angles.
3. Bar surfaces must be removed.
4. Hardening equipment must provide accurate control of temperature and atmosphere.
5. Use the best hardening and tempering temperature.
6. Quench baths must be clean, adequate in size and at proper temperature.
7. Straighten high speed tools at 1000° F. and oil hardening steel at 400° F.
8. Temper all tools as soon as they have cooled below 150° F. and double temper high-carbon, high-chromium and high-speed steels.
9. Grind using light depths and low feeds.
10. Use good toolsteel.

—**Reported by R. C. Behnke for West Michigan Chapter.**

—MEETING TOMORROW WITH METALS TODAY—

Nuclear Reactors Discussed At Dayton Chapter Meeting

Speaker: W. D. Manly
Oak Ridge National Laboratory

There are six parts to a "Nuclear Power Reactor", stated W. D. Manly, associate director of the Metallurgy Division, Oak Ridge National Laboratory, at a meeting in **Dayton.** They are: fuel, coolant, control, moderator, shield and structure. Mr. Manly amplified his remarks by drawing an analogy between a nuclear engine and a gasoline internal combustion engine.

Since there are a number of materials that can be used for each part of the reactor, the range of combinations that can be used to design the specific nuclear power unit is quite high. But the aim in designing a nuclear power reactor, just as in designing a gasoline engine, is to produce power at the lowest unit cost.

To illustrate the principles involved in reactor design, Mr. Manly hypothesized the use of a nuclear power unit in an automobile. By tabulating the properties of the materials presently available for each of the six parts of the reactor, and evaluating their relative costs, he evolved the basic design of the power unit. Anyone interested in manufacturing the "Purple Flash" may contact Mr. Manly directly.—**Reported by Joseph Warga for Dayton.**

Describes Corrosion Forms At Purdue Chapter Meeting

Speaker: M. G. Fontana
Ohio State University

Mars G. Fontana, chairman and professor, Ohio State University, Department of Metallurgical Engineering, spoke at **Purdue** on "The Eight Forms of Corrosion and Examples of Industrial Occurrence".

The eight forms of corrosion, which can be defined broadly as the "eating away" of metals, are uniform corrosion, galvanic or two-metal corrosion, concentration cell or crevice corrosion, pitting, dezincification, intergranular corrosion, stress corrosion and erosion corrosion.

There are eight major ways to combat corrosion: alloying for better corrosion resistance; cathodic protection; metallic coatings; organic and inorganic coatings; alteration of environment; use of nonmetallic materials; metal purification; and design changes. Of all the methods used, cathodic protection is the cheapest. An example is the connection of magnesium anodes to oil pipelines. This method will protect the pipeline from a month to many years, depending upon the environment of the pipe.

As shown by color slides, the oil rigs in the Gulf of Mexico demonstrate the combination of a number of methods to prevent corrosion of the supports. The rigs are protected by magnesium anodes, by corrosion resistant Monel covers around the supports near the waterline, by organic coatings such as Vinyl, and by rust inhibitors in the stagnant water inside of the supports.

Prof. Fontana concluded by discussing the other forms of corrosion. --**Reported by Terrence B. Lindemer for Purdue.**

Cites Rocket and Space Ship Problems

Shown at a Meeting of the Chattanooga Chapter Are, From Left: Wolfgang Steurer, Army Ballistic Missile Agency, Redstone Arsenal, Who Spoke on "Rockets and Space Ships—Their Development and Their Metallurgical Problems"; John Pikciunas, Chairman; and Charles Pandelis, Chapter Secretary

Speaker: Wolfgang H. Steurer
Redstone Arsenal

Members of the **Chattanooga Chapter** heard a talk on "Rockets and Space Ships—Their Development and Their Metallurgical Problems" by Wolfgang H. Steurer, chief, materials research, Army Ballistic Missile Agency, Redstone Arsenal. Dr. Steurer showed two films, one showed a series of rockets being fired, including the Little John, Nike, Hercules and Redstone, using both solid and liquid propellants, and the second showed the setting up, fueling with liquid oxygen, alcohol and hydrogen peroxide, and firing of the Redstone rocket.

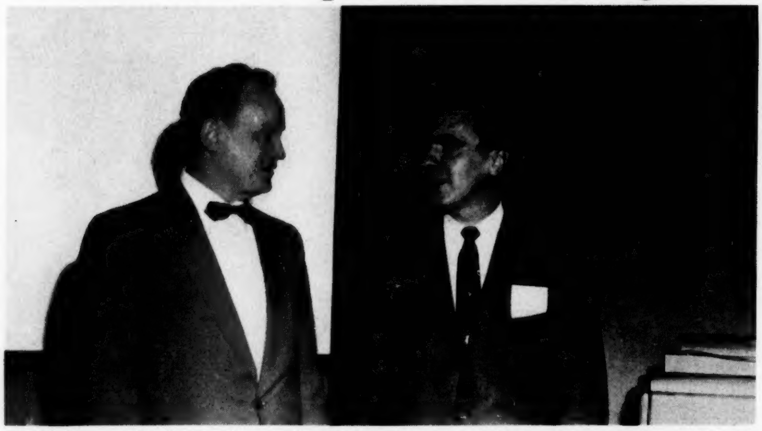
Dr. Steurer gave a short history of rockets, then described the problems to be solved in getting a rocket through space. The most severe problems arise from the heat generated in passing through the atmosphere. During re-entry, the skin temperature may reach thousands of degrees Fahrenheit. Two problems of materials engineering described were the obtaining of material strong enough to be structurally sound at this temperature and the dissipation of this heat. The first problem is met by getting the metal into a metastable condition, such as a cold worked condition, which is strong for a short time, but a long enough time to get the rocket through the atmosphere. The second problem is attacked by radiation, insulation, absorption of heat by the thermal capacity of the skin, or by using a composite structure with a material which is intended to melt and in doing so absorb heat from the structural material.

The launching by Russia of Sputnik was acknowledged by American rocket scientists to be a great accomplishment and at the same time heralded the start of a new type of war—a cold war in which nations will fight for supremacy in conquering outer space. The United States is best suited for winning this war if it is willing to put out a "tremendous effort" and is willing to adopt a master plan to decide "where we are going" and to direct the power and vigor of this country into the fight. The services can each contribute valuable work without duplicating the efforts of each other. Speaking of our educational system and its part in preparing scientists for use in this effort, Dr. Steurer said that youth must be taught to decide on a goal and led to make plans for using in a definite way the knowledge he gains in school.—**Reported by J. H. McMinn for Chattanooga.**

Columbus Hosts National Officers

The Columbus Chapter Honored the National Officers and Ladies at a Meeting Held Recently During Which President G. M. Young, Aluminum Co. of Canada, Ltd., Gave an Illustrated "Resume of the Metal Industry". Shown during the meeting, clockwise: Mrs. O. E. Harder; secretary W. H. Eisenman; Mrs. Young; G. K. Wood, Chapter chairman; Mrs. Wood; Mr. Young; Mrs. and Dr. C. H. Lorig. (Reported by R. E. Christin for the Columbus Chapter)

Discusses Graphitic Iron Castings



F. B. Rote (Right), Albion Malleable Iron Co., Who Presented a Talk on "Graphitic Iron Castings for Modern and Future Automobiles" at a Meeting in Detroit, Is Shown With Raymond S. Amala, the Technical Chairman

Speaker: F. B. Rote
Albion Malleable Iron Co.

F. B. Rote, technical director, Albion Malleable Iron Co., spoke on "Graphitic Iron Castings for Modern and Future Automobiles" at **Detroit.**

Dr. Rote classified the available types of graphitic cast iron according to the shape of the graphite present. Flake graphite ("potato chip" shape) provides the maximum interruption in the metallic matrix, resulting in high damping capacity and low elastic modulus. The rough nodules or flake aggregates typical of temper carbon ("pop corn" shape) provide less interruption in the metallic matrix, resulting in higher aggregate strength and modulus with appreciable ductility. Spheroidal graphite ("marble" shape) provides the least interruption in the metallic matrix, resulting in properties even closer to those of steel. In all types, the graphite acts as a reservoir of carbon for decarburizing or carburizing the matrix during cooling or in subsequent heat treatment, thus providing a wide range of properties and hardenability.

The advantages and limitations of each type of cast iron were then reviewed. Gray iron, in which properties are controlled primarily through control of melting and solidification, possesses the advantages of low cost, good machinability and good wear resistance, in addition to high damping capacity and low elastic modulus. The limitations are section sensitivity (the problem of avoiding massive carbide in the thin section of a casting while retaining acceptable strength in an adjoining heavy section) and lack of ductility because the graphite flakes act as stress raisers. Alloying and heat treatment can provide a wide range of strengths.

Ferritic malleable iron is an intermediate strength product. Advantages are freedom from stress (as a result of the complete annealing cycle), good machinability and sufficient ductility to press to close dimensions. One limitation is section thickness; since the iron must be cast white and subsequently annealed, it cannot be produced in heavy sections.

Pearlitic malleable iron has had the greatest recent growth in automotive applications. High strength combined with some ductility justifies its competition with steel forgings. The combined carbon content of the matrix can be controlled between 0.3 and 0.8% by proper heat treatment.

Spherulitic graphite iron (nodular iron) can be produced by direct melting and can be cast in heavy sections; the obvious advantages are high strength and ductility. The major limitation is section sensitivity (tendency for hard spots in thin sections), but even this can be overcome by relatively simple heat treatments since the carbon and silicon are high.

A new method of producing spherulitic graphite iron was described. The iron is white as-cast and has relatively high sulphur (approximately 0.45%) to overbalance the manganese; thus complex iron-manganese sulphide particles act as nuclei for formation of spherulitic graphite nodules during the malleablizing cycle. The process can be used with sections up to 8 in. thick.

After the discussion, a short movie was presented to illustrate the advances in the foundry industry that insure uniform properties and reduce costs.—**Reported by D. V. Doane for Detroit.**

—STRENGTH AND PEACE THROUGH METALS—

Explain What Industry Expects From Graduates

Speakers: Walter Crafts
Martin Brezin

Walter Crafts, Electro Metallurgical Co., and Martin Brezin, U. S. Steel Corp., spoke at a meeting of the **Penn State Chapter** on "What Industry Expects of a College Graduate".

Mr. Crafts discussed the qualities on which a junior engineer or scientist is rated for advancement in metallurgical research and development positions, while Mr. Brezin spoke on the qualities on which a junior metallurgist is rated for advancement in production, quality control and service positions.

A panel composed of Gerald Arey, Titan Metal Manufacturing Co., Robert Zong, Curtiss-Wright Corp., and Kenneth Pinnow, Pennsylvania State University, then joined the speakers to answer questions from the floor. —**Reported by Richard Heacox for Penn State.**

Metals for Space Age Described

D. W. Levinson, Nonferrous Research, Armour Research Foundation, Talked on "Metals for Rockets, Guided Missiles and High-Speed Aircraft" at a Meeting of Chicago-Western Chapter. Shown are, from left: R. W. Hansel, vice-chairman; Dr. Levinson; and H. B. Knowlton, the technical chairman

Discusses Uses for Semiconductors

Charles J. Gallagher, General Electric Research Laboratory, Spoke on "Semiconductors" at a Meeting Held Recently by Eastern New York Chapter. He is shown (holding sample) with a number of the members, including J. H. Westbrook, on Mr. Gallagher's left, technical chairman of the meeting

Speaker: C. J. Gallagher
General Electric Co.

"Semiconductors — Applications in Research and Industry" was the title of a talk given before the **Eastern New York Chapter** by Charles J. Gallagher, General Electric Co., Research Laboratory.

The present intense activity in the semiconductor field began accelerating about 1949. The speaker reviewed the semiconductor business and demonstrated some of the more unique properties of semiconductors.

A semiconductor is a rather poor conductor whose conductivity may be altered radically by a small change in its physical condition. A small change in impurity content, defects or temperature drastically changes their conductivity. Since a requisite of a semiconductor material is high purity, zone refining was employed in the purification of germanium, the first important material. Silicon, because of its ability to withstand higher temperatures, in both ambient temperature and power, is particularly interesting. Resistivity is a measure of impurity content. A 50 micro-ohm germanium crystal represents an impurity content of one part in ten million. Boron is very difficult to remove from silicon. To a very pure material, impurities are added to produce the required electrical response. Impurities are added by electroplating, alloying, diffusion, or growing from the melt. In rate-grown crystals, alternate layers of n-type and p-type material may be grown by varying the growth rate which varies the segregation of impurities. To overcome the diffusion zone between adjacent types of material and produce an abrupt junction, the melt-back technique was developed.

Phosphors are a group of semiconductors rapidly growing in importance. Mr. Gallagher demonstrated a light amplifier and an example of electroluminescence which utilizes phosphors.

Some of the research problems which plague the semiconductor business have aided greatly in the understanding of metallurgy. Diffusion, precipitation and nucleation, dislocations, radiation damage, conductivity, doping and solid solubility, and crystal growth, are areas where much insight has been gained because of the activity in semiconductors.

The talk was supplemented with slides including one showing Frank-Read dislocation loops in a silicon single crystal.—**Reported by Louis Ianiello for Eastern New York.**

—MASTERING METALS FOR MANKIND—

Describes Solar Battery At Meeting in Warren

Speaker: R. C. Clark
Ohio Bell Telephone Co.

Members of the **Warren Chapter** witnessed a demonstration of the "Bell Solar Battery" presented by Robert C. Clark, supervisor of public relations, Ohio Bell Telephone Co.

The Bell solar battery, made up of wafers of high-purity silicon, produces electric energy when exposed to any source of white light of proper wave length. Electric energy produced in daylight hours can be stored in storage batteries for use in the hours of darkness. One possible commercial application of the solar battery is as a power source in rural areas where conventional power sources are not available. Such an application has been made in Americus, Ga., where solar battery installations furnish electric energy for the rural telephone system. There is no limit to the life of the solar battery, with the exception of damage, because no deterioration of the battery takes place when it is used. Other commercial applications now being offered include sources of power for portable radios, toys, and the like.—**Reported by J. O. Williams for Warren.**

—PROGRESS THROUGH METAL SCIENCE—

Talks in Ottawa on Missile Metallurgy

Speaker: H. V. Kinsey
Department of Mines and Technical Surveys

At a meeting of the **Ottawa Valley Chapter,** H. V. Kinsey, head of the Refractory Metals Section, Department of Mines and Technical Surveys, spoke on "Missile Metallurgy".

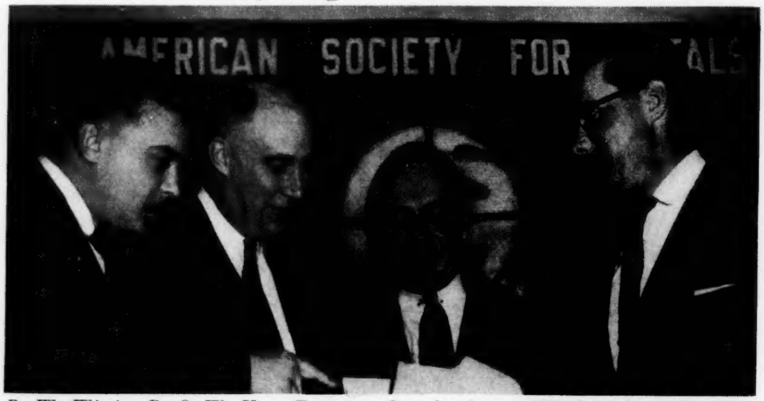
The problem of materials for the construction of vehicles traveling through the atmosphere at speeds up to 20 times the speed of sound was considered. As a result of aerodynamic heating, the temperature of the vehicle increases rapidly as the velocity is increased, but decreases as the altitude of flight increases. Thus the problem of materials of construction depends on both the velocity and the flight path to be followed. Deleterious effects of this heating result from warpage due to nonuniform thermal expansion, loss of strength at elevated temperatures, and corrosion, erosion or even melting of the outside skin.

Since, in many cases, the time of exposure to the heating conditions is limited to a few minutes or less, conventional test procedures give little information for design data. Testing procedures for tensile and creep tests have been worked out so that the tests may be completed less than a minute after the start of heating. For a perfectly pure annealed metal the soaking time at the testing temperature has no effect on the properties. However, even in commercial purity material, it is often found that the properties depend to a great extent on the soaking time at the testing temperature. These effects are even more marked in many age or transformation hardening alloys.

Although a very finely dispersed second phase is often not thermally stable over long periods of time, it leads to a higher strength than a thermally stable, coarsely dispersed second phase, and for this reason, the finely dispersed phase may be preferred if the time of exposure to the elevated temperature is sufficiently short. Similarly, cold working can lead to increased strength at elevated temperature provided that the time of exposure is sufficiently short.

Thus, it appears that metals will continue to play an important role in missile structures as parts that can withstand stress at elevated temperatures, or can absorb heat in the skin structure to protect the underlying structure.—**Reported by J. W. Suiter for Ottawa Valley.**

Heat Treating Topic at Western Ontario



B. W. Wittig, B. & W. Heat Treating Co., Spoke on "Modern Heat Treating Practice" at a Meeting of the Western Ontario Chapter. Shown are, from left: R. Cyr, chairman; J. J. Tickens, Hartley Foundry; Mr. Wittig; and W. McIntyre, vice-chairman of the chapter. (Reported by Frank Miller)

Worcester Hears Talk on Deep Drawing

Shown at the Past Chairmen's Night Meeting of Worcester Chapter Are, From Left: Richard J. Uppvall, Technical Chairman; Paul G. Nelson, Budd Co., Who Spoke on "Deep Drawing and Forming of Stainless and Carbon Steel"; Walter J. Nartowt, chairman; and Leonard L. Krasnow, vice-chairman

Panel Covers General Metallurgy

Shown at a Meeting of the Kansas City Chapter Are Panel Members Who Discussed Such Subjects as Basic Metallurgy, Aluminum Finishing, Heat Treatment, Welding, Galvanizing and Plating. They are from left: Thomas Nichol, Gerald Hummon; LeRoy Campbell, Warren Hazelton, Pat Kenyon, Dave Goldberg, E. Knapp and Henry DeWitt. Mr. Humman was moderator

Compliments

To W. J. REAGAN, associate professor of metallurgy, on his retirement from the faculty of Pennsylvania State University on Jan. 31. Prof. Reagan is a 25-year member A.S.M. and is past chairman of both the Pittsburgh and Warren Chapters. He will continue to do consulting work from his home in State College, Pa.

◆ ◆ ◆

To THOMAS W. FERGUSON, JR., who was given the annual Distinguished Service Award of the Landsdale, Pa., Junior Chamber of Commerce for his contributions to the betterment of his community. He is general manager of the J. W. Rex Co., Inc., and a member of the Philadelphia Chapter.

◆ ◆ ◆

To B. R. NIJHAWAN, director, National Metallurgical Laboratory, Jamshedpur, India, on receiving the award of Padma Shri by the president of the Union Republic of India in recognition of his exceptionally distinguished services in the fields of science in India.

◆ ◆ ◆

To Crucible Steel Co. of America's PETER PAYSON, assistant director of research, and WALTER L. FINLAY, manager of the Midland research laboratory, who have been reappointed by the National Advisory Committee for Aeronautics to the Subcommittee on Aircraft Structural Materials. Mr. Payson has served as chairman of the publications committee and as a member of the Handbook Committee for A.S.M.

◆ ◆ ◆

To MONTE J. POOL, senior in metallurgical engineering at University of Cincinnati, on being chosen to receive the Esslinger Award of the Cincinnati Chapter, awarded annually to the outstanding metallurgical student at the University.

◆ ◆ ◆

To MRS. CHARLES WAGNER (Lillian Bauer), on the recent write-up in the Detroit *Free Press* which covers her resignation as Michigan representative for the W. S. Rockwell Co. The article points out that she will be replaced by a sales agency of 12 men when she quits the position she took over 10 years ago when her first husband died and she took over his job as representative for Rockwell.

DUPLICATE COPIES

Duplicate copies of Metals Review, for persons interested in keeping up a clipping file of annotations appearing in the monthly Review of Metal Literature, may be obtained at a nominal price of $2 per year. This arrangement can be made with members and subscribers who receive Metals Review with their memberships or at the regular subscription cost.

Presents Talk at Tri-City on Metal Cutting

Speaker: Norman Zlatin

Metcut Research Associates

Norman Zlatin, Metcut Research Associates, spoke on "Metal Cutting" at a meeting held by the **Tri-City Chapter.** He outlined the principles involved in the machining of cast iron, steel, leaded steels and titanium.

Mr. Zlatin described machinability as reasonable tool life, or good tool life with reasonable cutting speeds. He outlined some of the methods used to measure the machinability of various metals.

Causes to tool wear were discussed, including the affinity of tool and work, high temperatures, abrasiveness due to hard constituents of the work and work hardening. He mentioned the wide variations in the machinability of cast irons, stating that many of the difficulties were caused by massive cementite and various undesirable surface conditions.

In commenting on ceramic tools, the speaker mentioned that sufficient data are now available to accurately evaluate their performance.—**Reported by Eric Welander for Tri-City Chapter.**

Mahoning Completes Course On Cold Finished Materials

The **Mahoning Valley Chapter** has just completed a four-lecture educational course on "Users' Fabricating Problems—Cold Finished Materials". Each lecture was handled as a panel meeting in which oral and written questions were answered by a panel of experts. The meetings and the panel members were as follows:

Carbon Steel Strip and Sheets, by E. S. Bumps, Jones & Laughlin Steel Corp., D. C. Ewing, U. S. Steel Corp., J. A. Helbing, Republic Steel Corp., H. A. Holberson, Youngstown Metal Products Co., A. R. Roth, Jr., Roll Formed Products Co., and A. H. Vaughan, Electric Furnace Co.

Cold Drawn Tubes and Wire, by James Kelley, Jones & Laughlin Steel Corp., Ralph R. Leo, American Steel & Wire Division, U. S. Steel Corp., and Paul E. Moore, Youngstown Sheet and Tube Co.

Nonferrous Strip, by A. R. Roth, Jr., Roll Formed Products Co., M. R. Schuster, Aluminum Co. of America, and G. B. Wood, Jr., Scovill Manufacturing Co.

Stainless and Alloy Steel Strip, by R. A. Filer, Sharon Steel Corp., K. W. Massey Superior Steel Corp., A. R. Roth, Jr., Roll Formed Products Co., and C. F. Schultz, Jones & Laughlin Steel Corp.

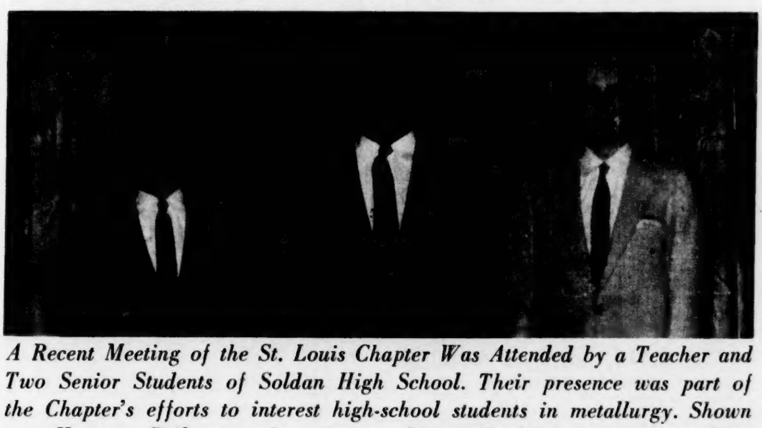
Young Is Canton-Massillon Guest

National President G. M. Young Spoke on the "Extrusion Process" at a Recent Meeting of the Canton-Massillon Chapter. Since Mr. Young will present this talk before many of the chapters this year, it will not be reprinted here. Shown are, from left: W. W. Scheel, vice-chairman; Ralph L. Wilson, past national president, chief metallurgist, Timken Roller Bearing Co.; Mr. Young; and G. Brainard Trumble, chairman of the Chapter

Past Chairmen Meet in Worcester

Past Chairmen of the Worcester Chapter Who Were Honored at a Recent Meeting Included, From Left: Warren V. N. Baker, Draper Corp.; Leo P. Tarasov, Norton Co.; Robert S. Morrow, Universal-Cyclops Steel Corp.; Lincoln G. Shaw, Pratt & Inman; Arnold L. Rustay, Wyman-Gordon Co.; Joseph C. Danec, Norton Co.; Harold J. Elmendorf, American Steel & Wire Division, U. S. Steel Corp.; Carroll C. Tucker, Reed & Prince Mfg. Co.; and Wilbur C. Searle, Reed & Prince Mfg. Co. (Reported by C. W. Russell)

Students Are Guests at St. Louis



A Recent Meeting of the St. Louis Chapter Was Attended by a Teacher and Two Senior Students of Soldan High School. Their presence was part of the Chapter's efforts to interest high-school students in metallurgy. Shown are Herman Bailey, mathematics teacher and the two guest students

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Inustrial Journals and Books Here and Abroad Received During the Past Month

Prepared at the Center for Documentation and Communication Research, Western Reserve University, Cleveland, With the Cooperation of the John Crerar Library, Chicago.

Annotations carrying the designation (CMA) following the reference are published also in *Crerar Metals Abstracts*.

A General Metallurgy

153-A. Place of the Iron and Steel Industry in the Australian Economy. I. M. McLennan. *Australasian Institute of Mining and Metallurgy, Proceedings,* no. 183, Sept. 1957, p. 1-16.
(A general, A4, ST)

154-A. Metallurgical Engineering and Atomic Energy. R. Carson Dalzell. *Journal of Engineering Education,* v. 48, Dec. 1957, p. 188-192.
Role of metallurgy and ceramics in atomic energy; educational programs for engineers initiated by A.E.C. (A3, T11, W11p)

155-A.* U. S. Progress in Titanium During 1957. W. J. Harris, Jr. *Journal of Metals,* v. 10, Jan. 1958, p. 19-20.
Sponge capacity; continuous cold strip rolling; heat treating techniques; new alloys; temperature and weldability limitations; costs; future outlook. (A general; Ti)

156-A.* Titanium in Britain and the Continent. Eric Swainson. *Journal of Metals,* v. 10, Jan. 1958, p. 21-24.
Titanium sponge, ingot and fabricated forms are now produced commercially in France, Western Germany and Britain. In addition, pilot plants have been operated in Sweden, Italy and Austria, and commercial production may have started. Description of sodium reduction process developed in England by Imperial Chemical Industries Ltd. (A4p, C19; Ti)

157-A. Soviet Titanium Research and Production. John P. Nielsen. *Journal of Metals,* v. 10, Jan. 1958, p. 25-26.
Russian progress as observed in a visit to the USSR. (A4p, A9; Ti)

158-A. Aluminum and France. F. Weston Starratt. *Journal of Metals,* v. 10, Jan. 1958, p. 38-43.
Bauxite mines, alumina plants and Al reduction works of Pechiney, France's leader in Al.
(A4, A11a, C general; Al)

159-A. Thirty Years in American Metallurgy. John J. B. Rutherford. *Metal Progress,* v. 73, Feb. 1958, p. 106-111.
In retrospect, the state of metallurgical art, science and industry existing in 1926 (when Sauveur gave a "modern" definition of the microconstituents in steel) appears rather elementary in many fields—metallography, materials, manufacturing methods, control.
(A2, M general)

160-A. Alloys for Making Castings. J. L. Rice, R. W. Ruddle and P. A. Russell. *Machinery Market,* no. 2980, Dec. 28, 1957, p. 24-26.
Development of superalloys for service up to 800° C. and higher. These are of four general types: (1) primary ferrous alloys containing substantial amounts of Ni and Cr, (2) alloys whose major constituents are Cr, Ni and Co, (3) Ni-base alloys, (4) Co-base alloys.
(A general, 5; SGA-h, Ni, Cr, Co)

161-A. Salaries of Metallurgists. Walter Morrison. *Metal Progress,* v. 73, Feb. 1958, p. 93-96.
A survey of all members classed as metallurgists or metallurgical engineers shows that, on the average, starting salaries measured in present-day purchasing power have steadily increased since the depression years, and as much as 45% since 1949. Their salaries are considerably higher than those of the 108,000 engineers surveyed in 1956 by Engineers Joint Council. (A6q)

162-A.* (French.) **Commercial Grades of Ferronickel and Their Principal Applications. Pt. 2.** Jean A. Ternisien. *Metallurgie et la Construction Mécanique,* v. 89, Nov. 1957, p. 917-925.
Composition and properties, mechanical, magnetic and electrical, and commercial designations of 46 American and European alloys; applications of many, particularly in electrical and electronic equipment. 31 ref.
(A general, T1, 17-57; Fe, Ni, SGA-n)

163-A. (German.) **Properties and Manufacture of WC-Co Alloys.** W. J. Tretjakow. *Die Technik,* v. 12, Nov. 1957, p. 733-735.
8 ref. (A-general, Q-general; W, Co, 6-70)

164-A. (German.) **Geochemical Aspects of Rare Metals; Importance in Modern Technology.** H. Reh and H. J. Rosler. *Die Technik,* v. 12, Nov. 1957, p. 741-745.
Resources of Rb, Cs, Be, Ce, Ti, Hf, Th, V, Re, Pt, Ga, In, Tl, Ge, Se and Te. (A11a; RM-n)

The subject coding at the end of the annotations refers to the revised edition of the ASM-SLA Metallurgical Literature Classification. The revision is currently being completed by the A.S.M. Committee on Literature Classification, and will be published in full within the next few months.

165-A. (German.) **Titanium and Titanium Alloys.** U. Zwicker. *Die Technik,* v. 12, Dec. 1957, p. 815-818.
(A-general; Ti)

166-A. (Hungarian.) **History of Hungarian Art-Founding.** Laszlo Jakoby. *Kohaszati Lapok (Ontöde),* v. 12, June 1957, p. 135-138.
(A2, E general, T9q)

167-A. Metallurgical Development and Atomic Energy. John Cockcroft. *Atomics and Nuclear Energy,* v. 9, Jan. 1958, p. 5-6.
(A-general, T11, W11p)

168-A. Metallurgical Research. W. E. Dennis. *Atomics and Nuclear Energy,* v. 9, Jan. 1958, p. 7-9.
(A9m, T11)

169-A. Chromium. Technical Properties and Modern Uses. L. Sanderson. *Canadian Mining Journal,* v. 79, Jan. 1958, p. 78-79.
(A-general, Q-general, 17-57; Cr)

170-A. Titanium's Success Story. Roy J. Lamm. *Cornell Engineer,* v. 23, Jan. 1958, p. 28-30.
(A-general; Ti)

171-A. Redesigning With Gray Iron Castings. *Design Engineering,* v. 4, Feb. 1958, p. 31-32, 81.
(A-general, 17-57, 17-51; CI-n)

172-A. Planning and Operating Industrial Waste Plant in Plating Facility. G. J. O'Kane. *Engineering Journal,* v. 5, Jan-Feb-Mar. 1958, p. 8-11.
(A8b, L17)

173-A. New Techniques in Vacuum Metallurgy. Paul J. Halyard, Jr. *Florida Engineer,* v. 8, Jan. 1958, p. 29, 42.
(A-general, 1-73)

174-A. How Foundries Are Training Engineers. Jack C. Miske. *Foundry,* v. 86, Mar. 1958, p. 76-79.
(A3h, E-general)

175-A. What You Need for a Minimum Metallurgical Laboratory. Joseph R. Driear. *Foundry,* v. 86, Mar. 1958, p. 83.
(A9h, 1-53)

176-A.* How to Select a Resistance Heating Alloy. Robert J. Fabian. *Materials in Design Engineering,* v. 47, Feb. 1958, p. 104-108.
Heating alloys can be classified into four principal groups; Ni-Cr, Ni-Cr-Fe, Fe-Cr-Al-Co (some of the newer alloys in this group do not contain Co), and molybdenum disilicide. Properties, costs and uses.
(A-general, Q-general, 17-53, 17-57; SGA-q)

177-A.* Aluminium and Its Alloys in 1957. E. Elliott. *Metallurgia,* v. 57, Feb. 1958, p. 79-92.
Comprehensive review of literature of extraction, founding, fabri-

(*)Articles Available Through Photocopy Service; See Coupon, p. 63.

cation, constitution, properties and standardization. 216 ref. (A-general; Al; 10-54)

178-A. Recovery Tests on "Mint Sweep" From the Royal Mint, Perth, Western Australia. *School of Mines of Western Australia, Report 687*, May 27, 1957, 12 p.
Results of 14 experiments in recovery of Au and Ag from residual material at the Royal Mint, Perth. (A11d; Au, Ag)

179-A. Gold. J. P. Ryan and Kathleen M. McBreen. *U. S. Bureau of Mines Minerals Yearbook*, 1955, 22 p.
Production methods, monetary stock, foreign trade in U. S. and abroad. 5 ref. (A-general; Au)

180-A. Thorium. John E. Crawford. *U. S. Bureau of Mines Minerals Yearbook*, 1955, 8 p.
General review of production, uses and prices in U. S. and abroad. Use as source of fissionable material for nuclear-powered generating systems and for fabrication of guided missiles and jet aircraft; engine components. 26 ref. (A-general, T11g, T24, 17-57; Th)

181-A. Titanium. Jesse A. Miller. *U. S. Bureau of Mines Minerals Yearbook*, 1955, 23 p.
Production, uses and prices in U. S. and abroad. 50 ref. (A-general; Ti)

182-A. Tin-Bearing Placer Deposits Near Tofty, Hot Springs District, Central Alaska. Bruce I. Thomas. *U. S. Bureau of Mines, Report of Investigations 5373*, Dec. 1957, 56 p. (A11a; Sn)

183-A. Metallurgy in the Public Service. Julius J. Harwood. *U. S. Office of Naval Research, Research Reviews*, Jan. 1958, p. 14-19. (A9m)

184-A. (German.) **Application of Rare Metals in Modern Technology.** W. Schreiter. *Die Technik*, v. 12, Dec. 1957, p. 806-814.
Properties and technical applications of Cs, Ga, In, Tl, Ge, Te, Hf, Th, Re, Pt, Os, Pd, Rh and Ru. (A-general; EG-b, EG-c, EG-e)

185-A. (Hungarian.) **History of Hungarian Art. Founding.** Laszlo Jakoby. *Kohaszati Lapok*, v. 12, Apr-May 1957, p. 90-97.
(To be continued.) (A2, E-general, T9)

186-A. (Hungarian.) **Educational System for Metallurgical Engineers in Moscow.** Jozsef Verö. *Kohaszati Lapok*, v. 12, Mar. 1957, p. 97-105. (A3g)

187-A. (Hungarian.) **Survey of World Aluminum Situation.** Andras Domony. *Kohaszati Lapok*, v. 12, Mar. 1957, p. 130-139. (A4; Al)

188-A. (Hungarian.) **Aluminium Industry of Japan.** Tihamer Gedeon. *Kohaszati Lapok*, v. 12, Mar. 1957, p. 139-142. (A-general; Al)

189-A. (Hungarian.) **Improvement of Structural Steels by Alloying With Tungsten.** Lorant Sas. *Kohaszati Lapok*, v. 12, Apr-May 1957, p. 163-169. (A-general, M27, Q-general; AY, W)

190-A. (Russian.) **Metals and Semiconductors of High Purity.** N. N. Muroch. *Priroda*, Dec. 1957, p. 21-26.
Further advances in fields of electronics, radio engineering and heat resistant metals require metals and semiconductor elements of super high purity. Such metals as Cu, Zn, Pb, Ni proved inadequate for new requirements. (A-general, T1, 17-57; EG-j)

191-A.* Present and Potential Uses for Coal in the Canadian Metallurgical Industry. J. H. Walsh, J. C. Botham and H. P. Hudson. *Canadian Mining and Metallurgical Bulletin*, v. 51, Feb. 1958, p. 81-88. (*Transactions*, v. 51, 1958, p. 57-64)
The coal mining industry of Canada has not benefited to any great extent by the rapid growth of the steel industry. Development of nonblast furnace methods for treatment of ferrous ores and expansion of the nonferrous metals industry may provide new markets. 82 ref. (A-general, C-general, D-general; RM-j42)

192-A. Nickel Industry in 1957. John F. Thompson. *Iron and Steel*, v. 31, Feb. 1957, p. 69. (A4p; Ni)

193-A. (French.) **Vanadium.** Lucien Perruche. *Nature*, v. 3265, May 1957, p. 171-172.
Types of ores containing V, locations of deposits; methods of processing, applications, biological effects, brief commercial data. (A-general; V)

194-A. (French.) **Molybdenum.** Lucien Perruche. *Nature*, v. 3266, June 1957, p. 224-227.
Natural state, extraction processes, properties, uses in steels, chemistry, effects on human organisms. (A-general; Mo)

195-A. (Hungarian.) **History of Hungarian Art Founding.** Laszlo Jakoby. *Kohaszati Lapok*, v. 12, Jan-Feb. 1957, p. 1-8.
20 ref. (To be continued.) (A2, E-general, T9)

196-A. (Hungarian.) **Metallurgy of High-Purity Iron.** Béla Vécsey. *Kohaszati Lapok*, v. 12, Jan-Feb. 1957, p. 18-24.
12 ref. (A-general, Fe-a)

197-A. (Norwegian.) **Vanadium of the Fens Area.** Kaare Wyller Christensen and Thorbjorn M. Holager. *Tidsskrift for Kjemi, Bergvesen og Metallurgi*, v. 17, no. 9, 1957, p. 153-155.
Amount of vanadium in samples from Fens in Telemark, Norway. 14 ref. (A11a; V, RM-n)

198-A. (Spanish.) **Titanium, a New Element in Metallurgy.** M. Fuentes Bencomo, C. Gandara and R. Aparacio. *Ion*, v. 17, Nov. 1957, p. 605-612.
History and growth of Ti industry; commercial production methods (Kroll, Hunter, Degussa), laboratory methods, including process being studied by present authors based on electrolysis of Ti tetrachloride in molten bath of alkaline chlorides; smelting processes; physical, mechanical and chemical properties; applications. 29 ref. (A-general; Ti)

199-A. Metallurgy of the Unusual. William J. Kroll. *Chemistry and Industry*, no. 2, Jan. 11, 1958, p. 26-29.
Semi-humorous reminiscences. (A-general)

200-A. Uranium Deposits in Western North Dakota and Eastern Montana. Donald Towse. *Economic Geology*, v. 52, Dec. 1957, p. 904-913.
6 ref. (A4n, A11a; U)

201-A. Cadmium. Arnold M. Lansche. Preprint from "U. S. Bureau of Mines Minerals Yearbook", v. 1, 1955, 10 p.
Domestic production, consumption and uses; stocks, prices, foreign trade, technological developments; world picture. (A4; Cd)

202-A. Manganese. Gilbert L. DeHuff and Teresa Fratta. Preprint from "U. S. Bureau of Mines Minerals Yearbook", v. 1, 1955, 24 p.
U. S. production, consumption, importation statistics, prices, companies involved; technological developments. World production 1946-1955; facilities and operations outside U. S. 54 ref. (A4; Mn)

203-A. Silver. J. P. Ryan and Kathleen M. McBreen. Preprint from "U. S. Bureau of Mines Minerals Yearbook", v. 1, 1955, 18 p.
Production, market, consumption and use in industry and arts, monetary stocks, prices, technology, foreign trade. (A4; Ag)

204-A. Zinc. O. M. Bishop, A. J. Martin and Esther B. Miller. Preprint from "U. S. Bureau of Mines Minerals Yearbook", v. 1, 1955, 46 p.
U. S. production, consumption, prices, companies involved, types of plants, byproducts, stocks. Imports and exports; recent technological progress; world review of production 1946-1955. 43 ref. (A4; Zn)

205-A. (French.) **Metallurgy and Applications of Some Rare Metals.** V. Charrin. *Genie Civil*, v. 135, Jan. 1, 1958, p. 15-19.
(A-general; Cd, Ce, Cb, Ge, Ga, In, Ta)

206-A. (French.) **Recent Progress in the Metallurgy of Titanium and the Manufacture of Titanium Alloys.** *Genie Civil*, v. 135, Feb. 1, 1958, p. 58-64.
(A-general; Ti)

207-A. (German.) **Chromium-Titanium Pearlitic Malleable Iron.** W. Rubel. *Giesserei-Praxis*, Jan. 10, 1958, p. 2-6.
Properties of newly developed material, called CT-55-WOV, are obtained simply by melting, without pre or post treatment. Its advantages enable it to invade markets heretofore reserved for forged parts. (A-general; CI-s, *Cr, Ti*)

208-A. (German.) **Silicosis and Its Control in the Foundry.** Rudolf Bommert. *Giessereitechnik*, v. 3, Nov. 1957, p. 249-254.
(A7n, A8a, E-general)

209-A. (Japanese.) **Copper Deposits of Daiichi Myoho Mine, Yamanashi Prefecture.** Tadashi Kimura and Kojiro Komura. *Geological Survey of Japan, Bulletin*, v. 8, Mar. 1957, p. 41-43.
(A4n; Cu)

210-A. (Japanese.) **Titaniferous Iron Sand Ore Deposits at the Kunisaki Peninsula, Ooita Prefecture.** Ziro Nakazawa and Syuzi Maruyama. *Geological Survey of Japan, Bulletin*, v. 8, May 1957, p. 1-16.
(A4n; Fe, Ti)

211-A. (Japanese.) **Zinc and Lead Deposits in Yasui Mine, Hyogo Prefecture.** Kuman Haraguchi. *Geological Survey of Japan, Bulletin*, v. 8, May 1957, p. 37-40.
(A4n; Pb, Zn)

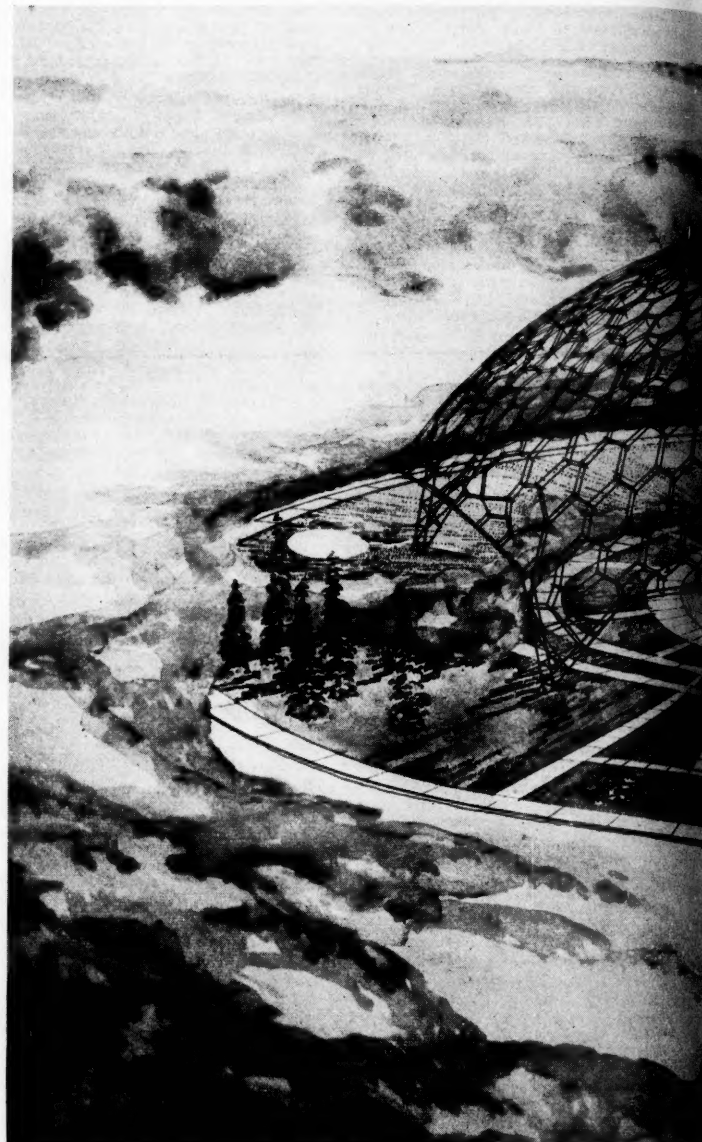
212-A. (Japanese.) **Cupriferous Pyrite Deposits of Sanyo Mine, Kumamoto Prefecture.** Nobuo Inai. *Geological Survey of Japan, Bulletin*, v. 8, June 1957, p. 49-54.
(A4n; Cu)

213-A.* (Book.) **Metallurgy of Vanadium.** William Rostoker. 185 p. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.
Comprehensive treatment of the extraction, physical and mechanical properties, oxidation, corrosion and embrittlement of V. The constitution of V alloy systems, metallography and use as an alloy addition. (A-general; V)

The A.S.M. of Tomorrow

A Preview of Step No. 1—

The New Headquarters Building for the American Society for Metals



Remarks by
John Terrence Kelly
Kelly and Kress, Architects, Cleveland

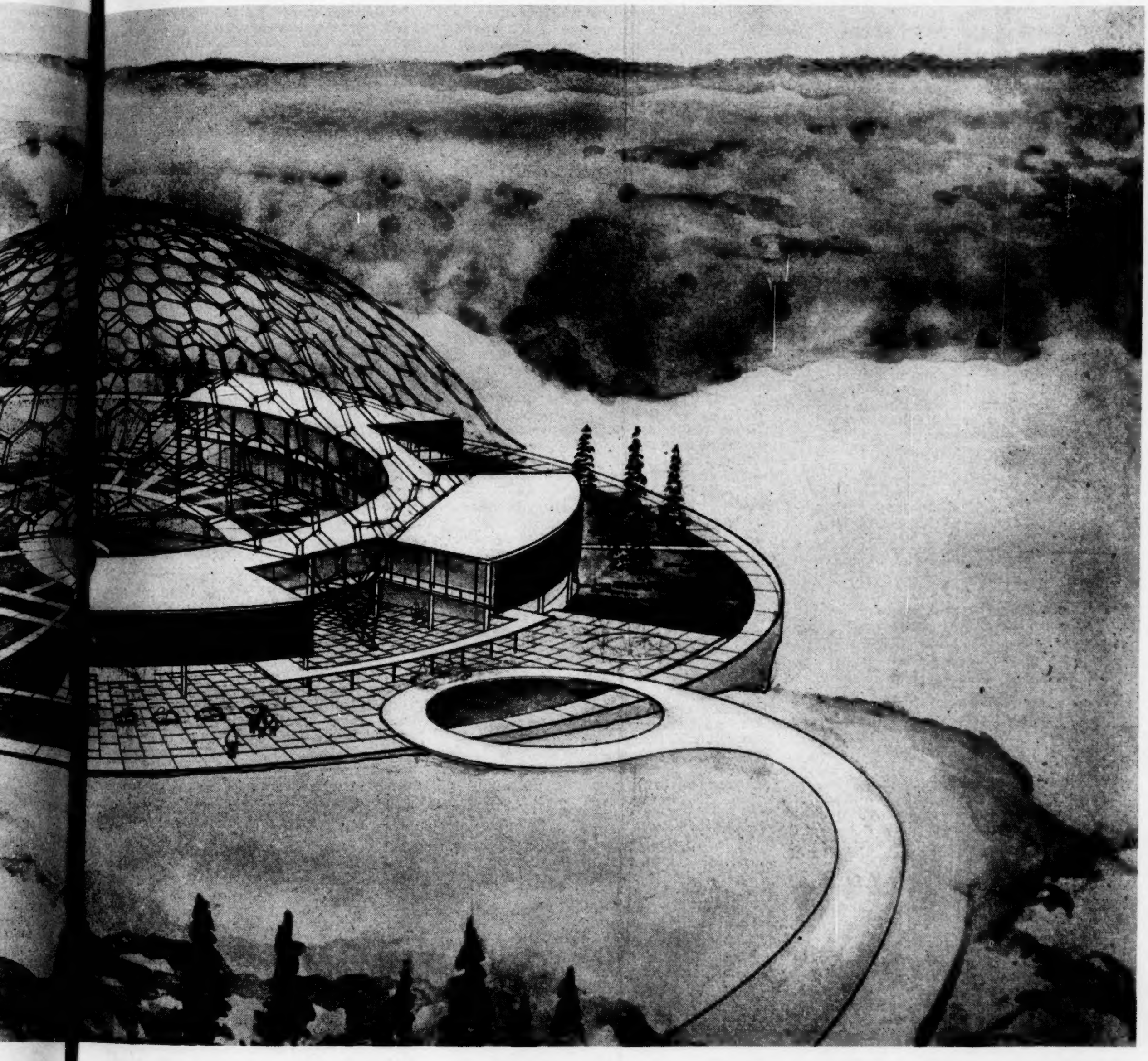
The new A.S.M. Headquarters Building presents the kind o. c..allenge ior which an architect will wait a lifetime. This challenge is in terms of pure design. In itself, this fact is significant. But let's look at our client. In A.S.M. we have one who not only encourages creative design, but who has shown patience while one evolves the design to a state of working perfection.

When you measure this situation against the complete disregard for beauty in our technology today, one quickly realizes that for an architect (whose job it is to synthesize his society's thoughts and actions in terms of building) this commission is overwhelming.

The completely beautiful site and its tranquil, yet majestic, qualities demanded, we felt, architecture that would compliment these qualities.. Further, it seemed that the concept should be a positive statement of "Man in Nature". Consequently, the design is a garden environment placed into the rolling hills which—we hope—will quietly become a part of the site in the rolling Ohio countryside.

This garden environment is made up of four elements: a 400-ft. diameter Garden Piazza, a Space Lattice, 250 ft. in diameter and 103 ft. in height, the Building proper, which acts as a vertical screen for the composition, and in the center of the Garden Piazza, a Mineral Garden, 100 ft. in diameter.

The Garden Piazza was carefully placed into the roll-



ing meadowland so that the machine cut grass and planting around the building will contrast with the long grass of the meadow. The desire to define the "garden environment" vertically, and still permit one to see the trees and sky, led to the use of a space lattice, and this thinking pushed us straight to the geodesic dome designed by Mr. Buckminster Fuller's Synergetics, Inc.

The dome, or rather double dome, will be a space lattice open to the sky. It will be constructed of 4-in. tubing in a hexagonal pattern, and will be supported on five pylons 22 ft. high. All of these pylons rise from the Garden Piazza. Two of them come down into courts of the building itself.

The building is semicircular in shape and defines the spaces of the Garden Piazza. It consists of three levels and contains approximately 50,000 sq. ft. The first level opens to the meadowland on the lower hillside. The top two levels open onto the Garden Piazza proper, and will form a "screen" against which people will enjoy the fountains and displays in the Mineral Garden in the center of the Garden Piazza.

With the Mineral Garden we hope to express the raw minerals and ores found in nature, and with the dome or "space lattice" to show what man with technology has accomplished with them.

The building itself will use many metals in many various ways with the express purpose of showing their beauty and utility.

The new A.S.M. Headquarters Building has given to us, the architects, the creative chance that too few realize. We humbly aspire to live up to the challenge A.S.M. has given to us.

B Ore and Raw Material Preparation

58-B. Some Experiences and Recent Developments in Sintering Australian Iron Ores. A. K. Farey. *Australasian Institute of Mining and Metallurgy, Proceedings,* no. 183, Sept. 1957, p. 107-152.

12 ref. (B16; Fe)

59-B. Lead and Zinc in California. J. Grant Goodwin. *California Journal of Mines and Geology,* v. 53, July-Oct. 1957, 58 p.

Geology, mines, smelting. 520 ref. (B general, A11a; Pb, Zn)

60-B. Dry Concentration of Iron Ore. *Engineering and Mining Journal,* v. 159, Jan. 1958, p. 88-89.

Using Quebec specular hematite crushed to 20-mesh and air classified to 200-mesh, it was found that the iron ore can be dry concentrated in high-tension separators to 65% Fe at better than 90% total Fe recovery. (B14n; B16b, Fe)

61-B. Beneficiation of Salem Iron Ores and Their Reduction With South Arcot Lignite. C. V. S. Ratnam and T. R. Balachandran. *Indian and Eastern Engineer,* v. 121, Oct. 1957, p. 233-238.

8 ref. (B13, B14, D8n; Fe)

62-B. Combustion of Carbon and Thermal Balance in Sintering. J. Michard. *Iron and Coal Trades Review,* v. 175, Dec. 27, 1957.

23 ref. (B16a, D11j; Fe)

63-B.* How Molten Aluminum Affects Plastic Refractories. H. A. McDonald, J. E. Dore and W. S. Peterson. *Journal of Metals,* v. 10, Jan. 1958, p. 35-37.

Three plastic refractory, alumina-silica compositions containing Al_2O_3, were compounded and rammed. Samples of each composition were fired to 1600, 1800 and 2000° F., and one 85% Al_2O_3 piece was fired to 2400° F. Test pieces were then exposed to 7075 Al alloy at 1400° F. for 168 hr. Resistance of a plastic refractory to attack and penetration by molten Al is a function of the uncalcined clay content of the material, and the phase changes in the clay wrought by prefiring. (B19d; Al, 14-60, RM-h)

64-B. Humphreys Spiral Concentrator. Its Place in Ore Dressing. James V. Thompson. *Mining Engineering,* v. 10, Jan. 1958, p. 84-87.

Requirements and fields of application for use of wet gravity concentrator. 9 ref. (B14g, W15p, 1-52; RM-n)

65-B. Electrostatic Separation of Minerals. M. B. Donald. *Research Applied in Industry,* v. 11, Jan. 1958, p. 19-25.

23 ref. (B14n)

66-B. Treatment of Auriferous Calcine From Cassilis, Victoria. J. T. Woodcock. *University of Melbourne, Ore-Dressing Investigations,* Report no. 531, May 1957, 16 p.

(B14h; Au)

67-B. (Russian.) **Magnetic Roasting of Low-Grade Hematite Ore in Layers.** V. I. Karmazin. *Metallurg,* Dec. 1957, p. 5-8.

Process of enriching ores at Krivoirog basin which consist of 60% hematite and 40% quartz. Method produces concentrates with no less than 65% iron and no more than 5-8% silica. (B15; Fe)

68-B. Iron-ore Nodulizing in a Rotary Kiln. M. Gerard. *Iron and Coal Trades Review,* v. 176, Jan. 17, 1958, p. 147-159.

An alternate process of iron-ore sintering by nodulizing ores, rolling them around the inside of a revolving vessel. Chemical and physical changes taking place inside nodulizing kiln. (B16c, 1-52; Fe)

69-B.* How Theory Can Help Make More Sinter. E. W. Voice and R. Wild. *Journal of Metals,* v. 10, Feb. 1958, p. 105-110.

Investigation by British Iron and Steel Research Assoc. concludes that while the fuel requirements are related to the heat requirements of the process, the air requirements are much more dependent on the heat capacity of the sinter mix than on the oxygen requirement of the fuel. A series of fronts travel down the bed during sintering; water evaporation, calcination, heat transfer and combustion. The efficiency of the process depends on these fronts traveling down the bed correctly phased with respect to each other. 6 ref. (B16, A11e)

70-B.* Updraft Pelletizing of Specular-Hematite Concentrates. Donald C. Violetta. *Journal of Metals,* v. 10, Feb. 1958, p. 118-121.

Updraft method rather than the conventional downdraft method provides several distinct advantages; there is no apparent limit of the maximum bed depth. Individual balling capacities are a fractional part of the traveling grate capacity, hence a specific balling device can form specific sizes of pellets, with particular quantities of fuel, and this charge can be placed in a specific location in the pellet bed. All operations of firing, such as drying, preheating, ignition, combustion, recuperation and cooling within the bed are conducted simultaneously. (B16b; Fe)

71-B. Downdraft Taconite Pellet Hardening. Alan English and M. F. Morgan. *Journal of Metals,* v. 10, Feb. 1958, p. 122-124.

Raw materials used in both the experimental and the commercial plants were similar and consisted of magnetic taconite concentrates, anthracite fines, bentonite and fuel oil. The main principle of pelletizing with the downdraft continuous-grate furnace, which embodies some of the features of a sintering machine, is the recovery and use of most of the sensible heat for drying and burning the product. (B16b, 1-52; Fe)

72-B. Pelletizing in Shaft Furnaces. F. D. DeVaney. *Journal of Metals,* v. 10, Feb. 1958, p. 125-128.

Furnace at Erie Mining Co. consists of a rectangular shaft 6 ft. wide, 14 ft. long and approximately 45 ft. high. The shaft is full at all times with pellets and an amount is drawn off from the bottom at the same rate the green balls are fed into the top, so as to keep the feed line uniform. The amount of pellets in the furnace is about 180 long tons, and these move continuously down the shaft at a rate of ½ to 1 in. per min., depending on the feed rate. (B16b, 1-52)

73-B. Lurgi Pelletizing Process: A Combined Updraft-Downdraft Technique. Kurt J. E. Meyer and Hans Rausch. *Journal of Metals,* v. 10, Feb. 1958, p. 129-133.

Special features of the Lurgi pelletizing process are that addition of binders is not necessary and gas or oil is used exclusively as fuel not incorporated in the pellets. The latter permits greater control of temperature and oxidizing conditions on sintering machine. Magnetite, hematite, limonite, or mixtures of these may be pelletized by this process. (B15b, 1-52)

74-B. Economics of Uranium Ore Processing. A. H. Ross and Ralph Toerper. *Mines Magazine,* v. 48, Jan. 1958, p. 43-44.

(B14, 17-53; U)

75-B. Laboratory Concentration of Chromite Ores, Red Mountain District, Kenai Peninsula, Alaska. R. R. Wells, F. T. Sterling, E. G. Erspamer and W. A. Stickney. *U. S. Bureau of Mines, Report of Investigations* 5377, Apr. 1957, 22 p.

(B14; Cr)

76-B. Concentration of Beryl Ore From Torington, N. S. W. *University of Melbourne, Ore-Dressing Investigations,* Report no. 532, May 1957, 4 p.

(B14; Be)

77-B. Table Concentration of Cobalt-Manganese Oxide Ore From Near Queenstown, Victoria. *University of Melbourne, Ore-Dressing Investigations,* Report no. 532, May 1957, 4 p.

(B14; Co, Mn)

78-B. (Hungarian.) **Comparative Examination of Salt Separation Methods in Alumina Plants.** Mihaly Mariassy. *Kohaszati Lapok,* v. 12, Mar. 1957, p. 126-129.

6 ref. (B-general, C23; Al, RM-n)

79-B. (Hungarian.) **Concentration of Manganese Carbonate Ores.** Lajos Burnoczky. *Kohaszati Lapok,* v. 12, June 1957, p. 240-246.

Concentration by washing, roasting and magnetic separation. Concentrate containing carbonate may be utilized for cast iron. (B14j, B13d, B15; Mn)

80-B.* (German.) **Study of Wear of Blast Furnace Brickwork by Radioactive Isotopes.** Joachim Holzhey. *Neue Hütte,* v. 2, Nov. 1957, p. 665-670.

Furnace construction; arrangement of ray sources; adsorption by brick work and steel plates; measurement; test data; radiation effect on the furnace; treatment of the radioactive pig iron. 4 ref. (B19d, 1-59, W17g)

81-B. Stockholm Mineral Dressing Congress. *Mine and Quarry Engineering,* v. 24, Feb. 1958, p. 61-69.

Mineral dressing processes; classification, gravity separation, magnetic concentration, roasting and sintering. (B14)

82-B.* Major Welding Manufacturer Recovers Rutile in Florida. *Engineering and Mining Journal,* v. 158, Dec. 1957, p. 98-99.

Design, operation of floating dredge and concentrating plant which up-grades feed containing only 2% heavy minerals to a concentrate containing 64%, including rutile, ilmenite and zircon. (B14; Ti)

83-B.* E&MJ's Flowsheet Design Book. *Engineering and Mining Journal,* v. 158, Dec. 1957, p. 145-160.

Flowsheets covering Cu flotation, Au roasting, flotation and cyanidation, Au amalgamation and cyanidation, magnetic separation and pelletizing of magnetic taconite, emulsion flotation of Mn, molybdenite recovery, Ge precipitation, Zn fuming, and combined leach-float for potash. (B14, B15, B16; Cu, Au, Ge, Fe, Mn, Mo, Zn)

(*) Articles Available Through Photocopy Service; See Coupon, p. 63

C — Extraction and Refining

98-C. **Production of High Purity Chromium From Fluoride Containing Electrolytes.** N. E. Ryan. *Australian Aeronautical Research Laboratories, Report Met. 26*, Jan. 13, 1958, 15 p.

Main requirements for efficient electrodeposition. 7 ref. (C23p; Cr)

99-C. **Preparation of Titanium-Aluminum Alloys by Alumino-Thermic Reduction. Pt. 1. Modified Reduction.** R. A. Sharma, A. N. Kapoor and A. B. Chatterjea. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 169-180.

7 ref. (C26; *Al*, Ti)

100-C. **Betterments in the Quality of Refined Lead.** T. S. Jacopi and B. H. Wadia. *Institution of Mining and Metallurgy, Bulletin,* v. 67, pt. 4, Jan. 1958, 20 p.

Improvements in casting technique for refined Pb ingots. 13 ref. (C5, 5-59; Pb)

101-C.* **High Purity Electrolytic Magnesium.** F. J. Krenzke, J. W. Hayes and D. L. Spell. *Journal of Metals,* v. 10, Jan. 1958, p. 28-30.

Five approaches to the impurity reduction problem: distillation of Mg metal; chemical treatment of molten metal; batch selection; chemical treatment of process liquors; changes in materials of construction of process equipment. Methods of analysis. (C19, C22h; Mg, 9-51)

102-C. **Metallurgical Problems Affecting the Economics of Aluminum Production.** Arthur F. Johnson. *Journal of Metals,* v. 10, Jan. 1958, p. 31-34.

Reduction methods and cost. (C21, C23; Al, 17-53)

103-C. **Behavior of Metals Other Than Uranium in Liquid-Liquid Extraction Processes.** C. J. Lewis and E. H. Chabtree. *Mining Congress Journal,* v. 44, Jan. 1958, p. 65-67.

Tentative conclusions indicate that metals existing in acid solution containing both anion and cation forms of the metal may be recovered by either organo-phosphate or amine liquid-liquid extraction reagents. (C19n)

104-C. **Zone Refining.** N. L. Parr. *Royal Institute of Chemistry,* Lecture no. 3, Mar. 13, 1957, 28 p.

13 ref. (C28k)

105-C. (German.) **Alkaline Electrolytic Extraction of Zinc From Tailings.** Bogumila Winsch and Wladyslaw Rutkowski. *Chemische Technik,* v. 9, Nov. 1957, p. 654-657.

Alkaline electrolysis in utilization of oxidized zinc-lead ores of low zinc content and tailings containing Zn. The final product is dendritic textured metallic powder. 6 ref. (C23p, A11d, H10b; Zn)

106-C. (Russian.) **Continuous Castings.** A. N. Myasoedov. *Liteinoe Proizvodstvo,* Dec. 1957, p. 1-3.

Method of intense cooling of ferrous and nonferrous metals so as to avoid cracks in ingot. 9 ref. (C5q, D9q, 1-67, 9-72)

107-C. **Laboratory Pressure Leaching Technique.** I. H. Warren. *Australian Journal of Applied Science,* v. 8, Dec. 1957, p. 317-322.

15 ref. (C19n)

108-C. **Leach Licks Arsenic Bugaboo in Metal Ore.** *Chemical Engineering,* v. 65, Jan. 13, 1958, p. 80-82.

Pressure leach purges As from Co ore, opens door to lower cost recovery of pure metal. Byproduct calcium arsenate and sodium sulphate add revenue. (C19n; Co, *As*)

109-C. **Searching for High-Purity Silicon.** *Chemical Week,* v. 82, Jan. 18, 1958, p. 55, 58, 60, 62.

Examination of old and new methods for processing Si; evaluation of the Siemens and Pechiney process. (C-general; Si)

110-C. **Electrolytic Production of Titanium.** H. N. Sinha and D. Swarup. *Indian and Eastern Engineer,* v. 121, Nov. 1957, p. 229-302.

17 ref. (C23n; Ti)

111-C. **New Approach to Electrolytic U.** L. W. Niedrach, B. E. Dearing and A. C. Schafer. *Nucleonics,* v. 16, Jan. 1958, p. 64-65.

Development of a process for continuous reduction of uranium analogous to Hall process for aluminum reduction. (C23n; U)

112-C. **Amalgamation of Cyanided Concentrate From Morning Star Mine, Woods Point, Victoria.** J. T. Woodcock. *University of Melbourne, Ore-Dressing Investigations,* Report no. 534, May 1957, 4 p.

Treatment of a percolation cyanide residue gave Au recovery up to 19%. (C29; Au)

113-C. (Hungarian.) **Thermodynamic Examination of Reduction of Zinc Oxide.** Zoltan Horvath. *Kohaszati Lapok,* v. 12, Mar. 1957, p. 112-119.

7 ref. (Concluded.) (C21, N15d; Zn)

114-C. (Hungarian.) **Cryolite Recovery in Aluminum Electrolysis.** Imre Molnar. *Kohaszati Lapok,* v. 12, July 1957, p. 300-311.

Methods for recovery of fluorine compounds by flotation and roasting. 21 ref. (C23n, A11c; Al)

115-C. (Hungarian.) **Thermodynamic Examination of Zinc Oxide Reduction.** Zoltan Horvath. *Kohaszati Lapok,* v. 12, Jan-Feb. 1957, p. 32-42.

(To be continued.) (C21, P12; Zn)

116-C. (Hungarian.) **Extraction of Vanadium From Aluminum Mill Tailings.** Imre Veres. *Kohaszati Lapok,* v. 12, Apr-May, 1957, p. 181-184.

Separation of vanadium oxide by means of sulphuric acid. (C19n, A11d; Al)

117-C. **Lithium Extraction From Run-of-Mine Spodumene Ore.** Harold J. Andrews. *Chemical Engineering Progress,* v. 54, Jan. 1958, p. 54-55.

(C19n; Li)

118-C. **Now Arc-Melting Pays Its Way in Copper.** *Chemical Week,* v. 82, Jan. 25, 1958, p. 45-48.

(C5h; Cu)

119-C.* **Role of Evaporation in Zone Refining Indium Antimonide.** K. F. Hulme and J. B. Mullin. *Journal of Electronics and Control,* v. 3, Aug. 1957, p. 160-170.

Experiments include work with material heavily doped with Zn, Cd, Te and As. Several lines of evidence show that the important acceptor impurities Zn and Cd are volatile from molten indium antimonide. The removal of acceptors by volatilization under appropriate experimental conditions, followed by zone refining, can yield material with less than 10^{14} excess donors per cc. 7 ref. (C28k; In, Sb)

120-C. **Recovery of Vanadium From Colorado Plateau Ores by Solvent Extraction.** David A. Ellis. Dow Chemical Co. *U. S. Atomic Energy Commission,* DOW-161, Sept. 1, 1957, 51 p. (Available at U. S. Office of Technical Services, $1.50.)

(C19n; U, V)

121-C.* (German.) **Settling Behavior of Copper Matte and Copper in Liquid Slags.** F. Johannsen and W. Wiese. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 11, Jan. 1958, p. 2-14.

Stokes' Law governs, which means that the settling speed depends on the size of the drops of the sulphides or of the Cu, on the viscosity of the slag and the difference in the specific weights between the liquid phases. Liquid Cu does not wet solid oxides and therefore forms round drops. The large drops forming in the melting of a sulphide-containing burden advance more rapidly through the layer of slag than small drops and can absorb the latter with increase in volume. 29 ref. (C21b; Cu, RM-q)

D — Iron and Steelmaking

104-D.* **Possibilities of Desulphurizing Blast Furnace Hot Metal. Pt. 1. Additions of Aluminum Near Iron Notch During Casting.** A. Banerjee, V. G. Paranjpe and S. Visvanathan. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 21-31.

Effects of Al additions are very marked with 0.8% Si hot metal but of low order in high-Si metal (1.48% Si). Almost negligible with metal containing 1.5% Si and 0.27% Ti, even if slag contains only 12% alumina. 8 ref. (D11n, D1b; RM-q, Fe, *Al*)

105-D.* **Possibility of Desulphurizing Blast Furnace Hot Metal. Pt. 2. By Injecting Fluidized Agents.** P. K. Chakravarty, V. G. Paranjpe and S. Visvanathan. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 33-50.

Fluidized injection of calcium cyanamide, calcium silicide, high-grade lime, 1.5% of metal weight, and fluidized powder of white slag, containing above 1% carbide, effects over 60% desulphurization. Lime is upgraded with calcium silicide, fluorspar or Al. Basicity of slag affects rate of sulphur pickup. 19 ref. (D11n, D1b; RM-q)

106-D.* **Distribution of Titanium Between Blast Furnace Metal and Slag.** P. Mehta and V. G. Paranjpe. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 51-60.

Titanium content of local pig iron varies from 0.12 to 0.21%; increasing temperature increases extent of reduction. Reduction is correlated with Si using reaction index K_{Si-Ti}, which increases with basicity and is decreased by increasing titania content in slag. Manganese recovery is correlated with Ti content of metal. 11 ref. (D11n, D1d; RM-q, Fe, *Ti*)

107-D.* **Direct Reduction of Iron Ore to Yield Usable Steel. Pt. 2.** Jatinder Mohan, P. K. Gupte and B. R. Nijhawan. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 73-81.

Sulaipat ore is electromagnetically concentrated to reduce gangue material and extruded in bars with different binding agents. The reduced product is forged and rolled and studied for density. The treated ore gives a crack-free product, easily forged and rolled and comparable

to steel manufactured in the usual way. 4 ref. (D8j; B14n, ST)

108-D.* (German.) **Importance of Vacuum Casting of Steel in Metallurgical Practice.** Zd. Eminger, F. Kinsky and Z. Kletecka. *Neue Hütte,* v. 2, Oct. 1957, p. 590-600. (Henry Brutcher, Altadena, Calif., Translation no. 4111.)

Reduction of hydrogen content by casting in vacuo; influence of different casting conditions on properties of structural steels. 7 ref. (D8m; ST)

109-D. (German.) **Origin and Elimination of Inclusions in Molten Metals.** E. Schwarz-Bergkaupf. *Radex Rundschau,* no. 5-6, 1957, p. 708-710.

Theoretical consideration of the deoxidation process in liquid iron. 6 ref. (D11r, 9-69)

110-D. (Hungarian.) **Purpose of Low-Shaft Blast Furnace.** Laszlo Visnyovszky. *Kohaszati Lapok,* v. 12, June 1957, p. 221-227.

Advantage of blowing with air enriched by oxygen. (D8n, D1h, W17h)

111-D. (Hungarian.) **Development of Continuous Casting.** Frigyes Arkos. *Kohaszati Lapok,* v. 12, June 1957, p. 234-239.

9 ref. (D9q)

112-D. (Russian.) **Eliminating Pulsation of Flame During Burning of Furnace Gases in Blast Heater.** V. G. Serdyukov. *Metallurg,* Dec. 1957, p. 11-13.

(D1b, W17g; RM-m39)

113-D. (Russian.) **Removing Slag With Extension-Type Plates.** G. M. Kroitman. *Metallurg,* Dec. 1957, p. 22-23.

Method of removing slag at Liebknekht plant during hot or cold remantling by specially constructed removable plates in slag chamber which result in considerable time saving. (D2d, W18r)

114-D. (Russian.) **Use of Extendable Chambers for Removal of Slags.** V. B. Kaplun and E. D. Akoltsev. *Metallurg,* Dec. 1957, p. 23-24.

(D2d, W18r)

115-D. Continuous Castings at Low Moor Alloy Steelworks Ltd. *British Steelmaker,* v. 24, Feb. 1958, p. 48-50.

(D9g; AY)

116-D. Developments in the European Steel Industries. D. J. O. Brandt. *Iron and Coal Trades Review,* v. 176, Jan. 17, 1958, p. 139-145.

Recent advances in techniques of ironmaking, steelmaking and steel casting in Belgium and Germany. Krupp-Renn Process, new rotor plants, degassing techniques and resistance heating. (D-general; ST)

117-D. (Hungarian.) **Production of Stainless Steels.** Ernö Weigl. *Kohaszati Lapok,* v. 12, July 1957, p. 275-286.

Steel production in induction furnaces. (D5, W18a, 1-52; SS)

118-D. (Hungarian.) **Production of Ferrotungsten in Electric Furnaces.** Antal Horvath. *Kohaszati Lapok,* v. 12, July 1957, p. 292-300.

(D5; AD-n, Fe, W)

119-D. Russian Experience With 500-Ton Open Hearth Furnaces. R. Sewell. *Iron and Steel,* v. 31, Feb. 1958, p. 61-62.

(D2, W18r)

120-D.* (French.) **Gasification With Oxygen-Enriched Air.** R. Alleyrac, L. de Saint Martin, R. Veuve and P. Leroy. *Institut de Recherches de la Siderurgie, Publications,* Series A, no. 173, Sept. 1957, 74 p.

Experiments conducted at Senelle Plant (openhearth) of Societe Lorraine-Escaut showed possibility of achieving a 29% rate of oxygen enrichment of air in gas producers with normal steam consumption, and of 27% in producers supercharged with steam, without any serious difficulty due to fusion of slag. Furnace performance was improved. At constant calorific output, productivity rose from 8.4 tons per hr. for operation with ordinary air to 9.7 for operation at rate of 29% oxygen enrichment, or an increase of 15.5%. Coal consumption decreased 13% under same conditions, costs of fabrication per ton did not increase. 25 ref. (D2g; ST)

121-D. (German.) **Production of Sponge Iron in Intermittently Operated Chamber Kilns of Coke Oven Type.** M. S. Kurtschatow. *Neue Hütte,* v. 2, Nov. 1957, p. 671-678. (Henry Brutcher, Altadena, Calif., Translation no. 4085.)

Direct reduction of iron. 23 ref. (D8j; Fe, 6-74)

122-D. (German.) **Electric Steel Slag Alloying Process.** Kurt Fellcht. *Neue Hütte,* v. 2, Dec. 1957, p. 731-737.

Slag reduction process for melting steel in the basic electric arc furnace. 3 ref. (D5d, D11n; AY)

123-D. (German.) **Production of Special Steels by Slag Alloying Process.** Hans-Joachim Eckstein. *Neue Hütte,* v. 2, Dec. 1957, p. 737-749.

23 ref. (D2d, D11n; AY)

124-D. (German.) **Desulphurization in the Basic Steel Converter.** Karl-Georg Speith, Hans vom Ende and Hans Vosskötter. *Stahl und Eisen,* v. 78, Feb. 6, 1958, p. 152-156.

16 ref. (D3, D11n, 1-65, 2-60; ST, S)

125-D.* (German.) **Use of Oxygen in an Openhearth Steel Plant.** Wilhelm Gerling and Karl-Otto Zimmer. *Stahl und Eisen,* v. 78, Feb. 6, 1958, p. 156-160.

Utilization of excess oxygen from generating plant; addition to gas producers; enrichment of combustion air in older type furnace. Increased melting rate and accelerated desulphurization and decarburization of low-carbon steels by use of oxygen lances. 4 ref. (D2g; ST)

126-D. (Hungarian.) **Economical Use of Manganese in Pig Iron and Steel Production.** Laszlo Visnvoyszky. *Kohaszati Lapok,* v. 12, Jan-Feb. 1957, p. 14-18.

(D1, D2; *Mn,* ST, CI-a)

127-D.* Industry Looks at Direct Reduction. James W. Franklin. *Engineering and Mining Journal,* v. 158, Dec. 1957, p. 84-93.

Advantages of direct reduction of iron ore; description of H-Iron, R-N, Krupp-Renn, Esso-Little, Madaras, Cyclosteel, Wiberg-Soderfors, Norsk-Staal, Domnarfvet Kiln, Sieurin, Hoganas, Monterrey, Cape-Brassert, Shipley and U. S. Steel-Dorr Oliver processes. (D8j, D8n; Fe)

128-D. Blast-Furnace Practice at the Societe Metallurgique de Knutange. Max Brun. *Iron and Coal Trades Review,* v. 176, Jan. 24, 1958, p. 207-209.

Comparison between effects of charging sinter and raw ore in blast furnaces shows advantages of sinter charging in a 30% increase in production, a 300-kg. reduction in quantity charged per ton produced, and improvement in quality of iron. (D1a; Fe, RM-n)

E Foundry

190-E. Epoxy Resins for Patternmaking. K. H. Coombs, M. van der Wende and D. Jepson. *Engineer and Foundryman,* v. 22, Nov. 1957, p. 56-62.

New materials for patternmaking which overcome disadvantages in using wood on metal. (E17, NM-d30)

191-E. Phosphorus Dilution of Iron in Small Experimental Cupola. P. K. Gupte, S. S. Bhatnagar and B. R. Nijhawan. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 61-72.

3 ref. (E10a, 2-60; CI, *P*)

192-E. Improvement in Mechanical Properties of Bronze Castings by Nitrogen Degasification. P. K. Chakravarty and S. Visvanathan. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 119-130.

19 ref. (E25g, Q general, 1-73; Cu-s, *N*)

193-E.* Investment Casting of Precious Metal Jewelry. Ralph H. Atkinson. *Metal Progress,* v. 73, Feb. 1958, p. 97-101.

Although basic principles are the same as in casting other metals, melting and casting methods for Pt, Pd, Ag and Au vary considerably from those used in producing turbine buckets and machine parts. (E15, T9s, 17-57; Pt, Pd, Ag, Au)

194-E. Design and Application of Investment Castings. Alan G. Dimond. *Western Machinery and Steel World,* v. 49, Jan. 1958, p. 78-82.

Used for casting of buckets for Solar's Jupiter gas turbine and for other castings of complex nature. (E15, T24b, 17-57; SS)

195-E.* (French.) **Contribution to Principles of Design of Light Alloy Castings. Pt. 3. Principles of Design as Influenced by Direction of Pour and Molding.** Charles Roinet. *Revue de l'Aluminium,* v. 34, p. 1233-1239.

(E23, E19, 17-51; Al)

196-E. (German.) **Behavior of Green Molding Sands During Shock Heating.** H. G. Levelink. *Giesserei,* v. 45, Jan. 1958, p. 1-9.

Surface defects on casting. 9 ref. (E18, E19a; 2-62, 9-71)

197-E. (German.) **Measurement of Mold Hardness and Standard Test Body.** Franz Hofmann. *Giesserei,* v. 45, Jan. 1958, p. 9-13.

Testing methods, results, evaluation. 6 ref. (E19r; S22)

198-E. (German.) **Use of a Synthetic Resin Core Binding Agent in the Steel Foundry.** Emil Lange. *Giesserei,* v. 45, Jan. 1958, p. 22-23.

(E21, NM-d34; ST)

199-E. (Hungarian.) **Some Properties of Cast Iron Containing Titanium.** Arpad Mocsy. *Kohaszati Lapok (Ontöde),* v. 12, June 1957, p. 121-129.

6 ref. (E25, P general, Q general; CI)

200-E. (Hungarian.) **Survey of Gating and Risering Systems.** Sandor Kalman. *Kohaszati Lapok (Ontöde),* v. 12, June 1957, p. 129-134.

27 ref. (E22p, E22q)

201-E. (Russian.) **Actual Problems in Metallurgy of Cast Iron.** A. F. Landa. *Liteinoe Proizvodstvo,* Oct. 1957, p. 13-15.

Special cooling technique for castings with widely different cross sections. (E25n; CI-r)

(*)Articles Available Through Photocopy Service; See Coupon, p. 63.

202-E. (Russian.) **Mechanization of Cleaning and Chipping of Castings.** P. I. Kozheurov. *Liteinoe Proizvodstvo,* Dec. 1957, p. 8-11.
(E24, 18-74)

203-E. **Pearlitic Malleable Manufacture and Use.** O. K. Hunsaker. *American Society of Mechanical Engineers,* Paper no. 57-A—241, Dec. 1957, 5 p.

Pearlitic malleable castings which have 45,000 psi. yield and 60,000 psi. ultimate strength to 80,000 psi. yield and 100,000 psi. ultimate strength with excellent heat treating properties.
(E11, Q-general; CI-s)

204-E. **Steps Taken by One Medium-Size Foundry to Meet Today's Competition.** C. H. Ker. *American Society of Mechanical Engineers,* Paper no. 57-A—242, Dec. 1957, 8 p.
(E-general, W19, A9)

205-E. **G. E. Foundry Modernization to Double Production in Ten Years.** Robert H. Herrmann. *Foundry,* v. 86, Mar. 1958, p. 70-75.

Facilities for producing gray iron castings weighing up to 3000 lb. in the foundries operated by General Electric Co. at Elmira, N. Y.
(E-general, 1-52; CI-n)

206-E.* **CO_2 Process Useful in Producing Experimental Castings.** R. L. Fehr and R. C. Harris. *Foundry,* v. 86, Mar. 1958, p. 80-82.

CO_2-hardened molds provided a convenient method of producing several experimental rigid fuse bodies at Frankford Arsenal.
(E19; NM-f45)

207-E. **Cast Epoxy Core Driers for Dielectric Ovens.** John M. Leaman and Phillips L. Morrison. *Foundry,* v. 86, Mar. 1958, p. 85-87.

Inexpensive cast epoxy driers developed for use with contoured sand cores cured in dielectric ovens provide required thermal and dielectric properties and are made easily and economically. (E21)

208-E.* **Effect of Grain Size on Physical Properties of Synthetic Molding Sand.** Carl E. Schubert. *Foundry,* v. 86, Mar. 1958, p. 88-91.

Tests on silica sands with various average grain sizes but with clay and moisture held constant indicate that green permeability decreases with finer sands, green compressive strength remains constant and dry compressive strength increases with finer sands. (E18r)

209-E.* **Surface Finish of Steel Castings.** David V. Atterton. *Foundry,* v. 86, Mar. 1958, p. 92-95.

Depth of molten metal penetration through sand pores controls the amount of burnt-on sand that has to be cleaned from a casting. The limit of penetration is defined by the location in the sand of the isothermal corresponding to the solidification temperature of the metal. Location of this isothermal is determined entirely by thermal factors such as thermal diffusivity of the sand and temperature of the metal-mold interface. Surface finish produced by new techniques such as chamotte molding. 8 ref.
(E25n; ST, 9-71)

210-E. (German.) **Castability of Some Alloys With High Nickel Content and Other Nickel Alloys.** D. R. Wood and J. F. Gregg. *Giesserei,* v. 45, Jan. 1958, p. 33-42.

6 ref. (E25p, 2-60; Ni)

211-E. (German.) **Production of Very Large Steel Castings From 13% Chromium Steel.** Georg Schmidt. *Giesserei,* v. 45, Jan. 1958, p. 43-47.
(E25q, E19, E21; SS, *Cr*)

212-E. (Hungarian.) **Oxidation at Surface of Molten Iron.** Gyula Nandori. *Kohaszati Lapok,* v. 12, Mar. 1957, p. 49-53.

Addition of Mn stops or diminishes oxidation. 8 ref.
(E25; Ci, *Mn,* 14-60)

213-E. (Hungarian.) **Preparation of Molding Sand.** Laszlo Demeter. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 73-77.
(E18)

214-E. (Hungarian.) **Laboratory Tests for Adhesive Strength of Core Binders.** Zoltan Juhasz. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 77-81.

4 ref. (E18n, E21)

215-E. (Hungarian.) **Experience With Wood Patterns Spread by Metal.** Lajos Hajdu. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 88-90.
(E17, W19j)

216-E. (Swedish.) **Design of Castings With Regard to Molding.** Alrik Ostberg. *Gjuteriet,* v. 47, Dec. 1957, p. 197-203.
(E19, 17-51)

217-E.* **Canadian Hot-Blast Water Cooled Cupola.** J. E. Rehder. *Foundry Trade Journal,* v. 104, Feb. 6, 1958, p. 143-146.

Advantages include; easily adjusted slag basicity; economy in refractory maintenance due to shell water-cooling; higher melting rate, lower coke requirements and decreased melting losses due to use of preheated ore supply; better control of iron composition, reduced need for repair. Initial cost is high but justifiable. (E10a, W18d; CI)

218-E.* **Metallurgical Aspects of Hot-Tearing in Cast Steel. Pt. 2.** Kurt Beckius. *Foundry Trade Journal,* v. 104, Feb. 6, 1958, p. 149-153.

Conditions under which tears form, characteristics of tears, effects of temperature and carbon content. 8 ref. (E25n, 2-60, 2-61; ST, 9-72)

219-E. **Casting Iron Cannon.** F. Evans. *Foundry Trade Journal,* v. 104, Feb. 6, 1958, p. 155-156.

Methods used from the 16th through 18th centuries for casting cannon. Initially a two-part mold consisting of the bore and the external shape were used. Later the cannon were cast solid and the bore drilled out. (E11, T2m; CI)

220-E.* **Application of Risers With High Atmospheric Pressure.** W. P. Desnizki. *Iron and Steel,* v. 31, Feb. 1958, p. 51-52.

Chromium-molybdenum steel was cast in an experimental plate, with compressed air being forced into a riser located near one end. Samples from various areas of the plate were analyzed. Steel content was reasonably uniform throughout; adequate density was maintained; air pressure did not guarantee freedom from cavities in thickened sections; oxidation of steel in riser did not affect over-all quantity.
(E22q; AY, *Cr, Mo*)

221-E.* **Aluminum Alloy Castings.** John L. Everhart. *Materials in Design Engineering,* v. 47, Feb. 1958, p. 125-144.

Sand, permanent mold and die castings, as well as investment and plaster mold castings. Specifications, engineering properties, design considerations, processing characteristics and applications. 11 ref.
(E-general; Al)

222-E. **Investment Casting Offers Design Freedom, Economy for Host of Industries.** Edouard C. Thys and Thierry N. Thys. *Western Metalworking,* v. 16, Jan. 1958, p. 49-51.
(E15)

223-E. (French.) **Pouring Design for the Production of Cast Iron Propellers.** *Journal d'Informations Techniques des Industries de la Fonderie,* no. 92, Nov-Dec. 1957, p. 3-4.

Shrinkage holes in area where blades join boss in heavy propeller castings (over 175 lb.) were eliminated by system of top pouring with ten pencil gates, sprues being removable from body of casting after machining with graving tool or nylon grinding wheel. (E22p, T22h; CI)

224-E. (French.) **Fabrication of Parts in Malleable Cast Iron.** *Journal d'Informations Techniques des Industries de la Fonderie,* no. 92, Nov-Dec. 1957, p. 5.

Tests to determine optimum conditions for casting circular plates from 2 to 3 meters in diameter, with 25 to 45-mm. panels on one face. Particular requirement was Brinell hardness of between 120 and 150 in finished casting. Exclusive use of hematite pig of given composition produced desired results. (E25; CI-s)

225-E. (French.) **Casting of Gear Cases in Light Alloy.** *Journal d'Informations Techniques des Industries de la Fonderie,* no. 92, Nov-Dec. 1957, p. 9-11.

Details of pattern and gating design; use of chills. 3200 pieces were produced, with only one reject.
(E17, E22p, E22r, EG-a39)

226-E. (German.) **Casting of Steel With Nitrogen as Protective Gas.** Paul Holtzhaussen and Hans Fiedler. *Neue Hütte,* v. 2, Nov. 1957, p. 685-691.

4 ref. (E23, E25; SS)

227-E. **Design and Production of Diecasting in Zinc Base and Aluminium Alloys.** P. A. R. Findlay. *Chartered Mechanical Engineer,* v. 5, Feb. 1958, p. 60-61.

Summary of paper to be published in *1958 Proceedings.*
(E13, 17-51; Al, Zn)

228-E. (German.) **Molding Machines.** H. Kalpers. *Giesserei-Praxis,* v. 75, Dec. 10, 1957, p. 508-511.

Historical review. (To be continued.) (E19, 1-52)

229-E. (German.) **Cracks in Cast Steel.** R. Domanowski. *Giesserei-Praxis,* v. 75, Dec. 10, 1957, p. 505-508.

(To be continued.) (E11, 9-72; ST)

230-E. (German.) **Air Preheating in Foundry Operation.** A. Hohmann. *Giesserei-Praxis,* Jan. 10, 1958, p. 6-8.

Convection and radiation in the transmission of heat. Gain of heat by the application of preheating of air or fuel estimated at up to 30%. Discussion of the now customary recuperators and their manner of working. Recuperators for cupola furnaces, air heaters with tubes, radiation recuperators, rotating drum melting furnaces. (E10a, E10b)

231-E. (German.) **Casting of Lead Bronze.** E. Brunhuber. *Giesserei-Praxis,* Jan. 10, 1958, p. 12-14.
(E25n, M24c; Cu-s, *Pb*)

232-E. (German.) **Unusual Defects in Light Metal Castings.** Helmut Rogoss. *Giessereitechnik,* v. 3, Nov. 1957, p. 241-244.
(E11, 9; Al)

233-E. (German.) **Casting Production and Defect Report. Productivity Determination and Quantitative Control.** Presented by the Collective Organization of the "Hüttenverein" Foundries. *Giessereitechnik,* v. 3, Nov. 1957, p. 244-248.
(E-general)

234-E. (German.) **Development of Pressure Casting.** V. von Reimer. *Werkstatt und Betrieb,* v. 91, Jan. 1958, p. 21-24.

Machines, die-cast Al parts, pressure casting forms and alloys. (E13, 3-74; Al)

235-E.* (Japanese.) **Influence of Tellurium on Cast Iron Containing Titanium.** Tohei Ototani and Yoichi Tokunaga. *Casting Institute of Japan, Journal,* v. 29, Dec. 1957, p. 831-837.

Fe-C-Si alloys containing 0.2% Ti were remelted in graphite crucible in kryptol furnace. Up to critical amount of Te addition, graphite structure changes, due to difference in growth rate of austenite and graphite in solidification, 0.003-0.005% Te changing eutectic graphite to coarse flakes. Ferrite matrix is formed around fine graphite with excess Te and hardness is decreased. 9 ref. (E25q, 2-60; CI-q, *Te, Ti*)

236-E.* (Japanese.) **Structural Changes of Cast Iron Caused by Melting in Contact With Various Oxides.** Masao Honma. *Casting Institute of Japan, Journal,* v. 29, Dec. 1957, p. 837-845.

Influence of oxides in the refractories. In argon and carbon monoxide atmosphere flake graphite structure becomes finer as influenced by SiO_2, MgO, BaO and CaO, in that order. With Al_2O_3 there is no change. Sulphur content is reduced in similar order. Deoxidation and desulphurization in argon atmosphere. In CO atmosphere changes in graphite structure are due to changes of sulphur content of alloys. 11 ref. (E25q, 2-66; CI)

237-E. (Japanese.) **Study of Binding Clays.** Ryojiro Kono and Ichiyu Imao. *Casting Institute of Japan, Journal,* v. 29, Dec. 1957, p. 853-858.

Influence of clay impurities and minerals on green compressive strength of foundry sands. 3 ref. (E18n, 3-69)

238-E.* (Japanese.) **Studies of Foundry Silica Sands. Pt. 3.** Umeji Harada and Keizo Nishiyama. *Casting Institute of Japan, Journal,* v. 29, Dec. 1957, p. 858-871.

Study of refractory properties of Tokai district silica sands by shock heating. Refractory quality in following order; synthetic silica sand, conical sand, natural sand, beach sand. 9 ref. (E18r)

F Primary Mechanical Working

86-F. Induction Heating for Forging. P. E. Hammarlund and Y. Sundberg. *ASEA Journal,* v. 30, no. 10, 1957, p. 127-134.

New applications of induction heating in modernization of forge shops. (F21b, 1-52, 1-69, F22)

87-F. Aluminium Extrusion Plant at Pietermaritzburg. *Engineer,* v. 204, Dec. 20, 1957, p. 912-914.

(F24, 18-67; Al)

88-F. Manufacture of Tin Plates in India. Y. A. Gopal Rao. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 223-229.

6 ref. (F23, L16; ST, *Sn,* 4-53)

89-F. Heating at High Speed. Norman H. Davies and Richard J. Reed. *Metal Progress,* v. 73, Feb. 1958, p. 79-84.

High-speed heating of metal requires both convection and radiation from furnace gases and walls considerably hotter than finishing temperature. Consequently, fast controls are necessary to prevent overheating the work if the production line slows down. (F21b, W20h, P11k)

90-F.* Modernization in Heating for Hot Forming. Philip W. Morse. *Metal Progress,* v. 73, Feb. 1958, p. 85-90.

A 60-cycle 3-phase current can economically heat billets for forging, upsetting or extrusion. After the magnetic change point is passed, 960-cycle coils—dual purpose—carry the temperature higher. Higher frequencies are used for smaller billets. Several completely automatic systems are described.
(F21b, W28s; ST, Mg, 4-52)

91-F.* Influence of Forging Temperature on Mechanical Properties of Al-V Titanium Alloys. L. S. Croan and F. J. Rizzitano. *American Society for Metals, Transactions,* v. 51, Preprint no. 75, 1957, 26 p.

Effects of forging temperature on the mechanical properties after heat treatment of several heats of 6% Al, 4% V and 7% Al, 4% V titanium alloys. A high-temperature production forging technique involving press forging from above the beta transus temperature and water quenching from the press has been developed. Toughness, as measured by V-notch Charpy impact resistance at −40° F. may be increased by as much as 50% without any significant effect on strength. Although a gradual loss in ductility results from the use of increasingly high forging temperatures, the loss is insignificant at the working temperatures recommended.
(F22, 2-61, Q27a, Q23p; Ti, *Al, V*)

92-F.* 'Controlled Cooling' of Hot Ingots in a Single-Ingot Pit at Appleby-Frodingham. A. Jackson, N. H. Turner and R. C. Walthew. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 114-118.

General application of the method depends on the deviation from expected casting and stripping times and from the intended sequence of rolling being reasonably controlled. Under these conditions the fuel consumption per ton of ingot may tend to go down towards 0.3 therms per ton as against the approximate 3 therms per ton consumed in the latest gas soakers installed, when dealing under similar conditions with ingots of equivalent track times. (F21b; ST, 5-54)

93-F. Roll-Separating Force and Minimum Thickness of Cold-Rolled Strips. K. Tong and G. Sachs. *Journal of Mechanics and Physics of Solids,* v. 6, no. 1, 1957, p. 35-46.

Theory for predicting roll-separating forces is based on concept that the process of plastic deformation in rolling may be approximated by that of the plane-strain compression between parallel plates. Method for determining coefficient of friction and flow stress of materials. 14 ref. (F23, Q24, Q9n; Cu, 4-53)

94-F.* Production and Conversion of Aluminium Foil. J. R. Green. *Metallurgia,* v. 57, Feb. 1958, p. 71-73.

Foil production, foil stock, rolling, separation, annealing, properties and applications. (F23; Al, 4-56)

95-F. (Hungarian.) **Calculation of Deformation Resistance in Hot and Cold Rolling.** Sandor Geleji. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 145-150.

Resistance could be determined by experiment only. 12 ref. (F23)

96-F. (Hungarian.) **Calibration of Rolls for Pipes With Constant Internal and Variable External Diameters.** Jenö Gati. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 170-175.

New rolling technology for pipes having varying profiles. 4 ref. (F26s, S23)

97-F.* Canadian Picture on Pipe, Tubing and Casting. D. A. Adamson. *Canadian Mining and Metallurgical Bulletin,* v. 51, Feb. 1958, p. 102-107.

Continuous butt welding, electric resistance welding, submerged arc welding, seamless tube forming processes in various Canadian plants. Mannesmenn process for making seamles tubing. Size and tonnage capacities of the plants. (F26, 10-55)

98-F.* Designing for Cored Forgings. Carl J. Pfeifer. *Materials in Design Engineering,* v. 47, Feb. 1958, p. 122-124.

A cored forging is produced by a combination of closed die forging and extrusion. The special press required is equipped with mechanisms to introduce core pins, mechanically, immediately before pressure is exerted on the hot metal. The metal is forced to flow by displacement, filling the cavity and at the same time extruding around the cores to form cavities. (F22k, 17-51)

99-F. Lubricants for Wire-Drawing Dies. Pt. 2. W. M. Halliday. *Wire Industry,* v. 25, Jan. 1958, p. 59-62.

(Conclusion.) (F28, W24n; NM-h)

100-F. (German.) **Use of Fuel Oil in Forging Plants.** Karl-Heinz Weber. *Stahl und Eisen,* v. 78, Jan. 23, 1958, p. 87-93.

(F21b, W20h, 1-55; RM-k30)

101-F. (Hungarian.) **Determination of the Velocity of Deformation in Extrusion and Drawing.** Jozsef Kocsis. *Kohaszati Lapok,* v. 12, Jan-Feb. 1957, p. 71-75.

(F24, F27, F28, G4, 3-67)

102-F. (Hungarian.) **Extrusion Failures in Nonferrous Semifinished Products.** Zoltan Hegedüs. *Kohaszati Lapok,* v. 12, Jan-Feb. 1957, p. 75-79.

12 ref. (F24, 9; EG-a38)

103-F.* (Italian.) **Defects in Light Alloy Forgings and Stampings.** Eugenio Hugony. *Rivista di Meccanica,* v. 8, Nov. 23, 1957, p. 37-39.

Defects in parts submitted to Light Metals Experimental Institute, Milan, were analyzed as follows: Part made of Al-Cu-Mg alloy had cracks and blisters caused respectively by improper heating conditions during forging, and overheating during heat treatment; part in Al-Si-Mg alloy had developed blisters due to inclusions during melting and casting of original metal; group of difficult-to-machine parts in Al-Si-Mg alloy had not been properly tempered, contained foundry inclusions. (F22, C5, 9-72, 9-69; Al)

104-F.* (Swedish.) **Determination of Die Wear in Wiredrawing With Radioactive Isotopes.** Erik Lindstrand. *Jernkontorets Annaler,* v. 141, Dec. 1957, p. 837-846.

Mild steel wire was drawn through three irradiated tungsten carbide dies. Arc-shaped shavings from a third of the wire periphery were packed in scintillation detector. Count rates from tests performed with different coatings and lubricants showed amount of wear debris ranged from 0.5 x 10^{-8} to 5 x 10^{-8} g. per m. of drawn wire.
(F28, Q9, X2c, W24n, 1-59)

(*)Articles Available Through Photocopy Service; See Coupon, p. 6

105-F.* (German.) **Finish Rolling of Cylindrical Trunnions With Diameter of 1.5-5 Mm. by Plunge Method.** G. Pahlitzsch and H. J. von Eitzen. *Werkstattstechnik und Maschinenbau,* v. 47, Nov. 1957, p. 589-597.

Mechanism of finish rolling; technique of rolling small articles. Stress in worked article; construction of finishing rolls; influence of working conditions; influence of properties of materials. Adherence to standard tolerances. (F23q, W23k, 1-52)

Secondary Mechanical Working

Forming and Machining

144-G. Production Research in Metal Cutting. M. Eugene Merchant. *ASME Paper 57-A-99,* Dec. 1957, 5 p.

Basic method for securing production results in metal-cutting research through unified scientific and engineering approach. 5 ref. (G17, A9)

145-G. Machinability of High-Strength Gray Cast Irons. I. Ham, J. R. Roubik and J. P. Bunce. *ASME Paper No. 57-A-239,* Dec. 1957, 12 p.

11 ref. (G17k; CI-c)

146-G. Roll Forming—Chipless Production. K. W. Stalker. *ASME Paper No. 57-A-271,* Dec. 1957, 9 p.

Cold-forming process for making cylindrical and conical parts. Processing variables and examples of products. (G11, 1-67)

147-G. Chemical Milling of Magnesium. Hugh H. Muller. *Machine Design,* v. 30, Jan. 9, 1958, p. 137-138.

(G24b; Mg)

148-G. Aircraft Manufacturing Practice. Pt. 2. A Review of the British Industry. L. G. Burnard. *Machinery,* v. 92, Jan. 10, 1958, p. 97-106.

Pipe bending, sheet metal forming, chemical milling, honeycomb brazing. (G1, G6, G24b, K8, T24)

149-G. New Spark-Machining Technique. J. D. Shoemaker. *Machinery,* v. 92, Jan. 10, 1958, p. 74-76.

Lockheed Aircraft Corp.'s method for finishing cavities of impact extrusion dies. Inverting electrode needle gives rigidity, and coolant flowing in opposite direction of electrode increases machinery speed and improves finish. (G24a, W24n)

150-G. How to Fabricate Stainless Steels. Pt. 1. W. E. McFee. *Metal Products Manufacturing,* v. 15, Jan. 1958, p. 33-35, 68.

Fabrication of various grades, good die practice, die lubricants, annealing, roll forming, spinning, cutting and shearing. (G-general, J23; SS)

151-G. Cutting Fluid Selection. *Metal Progress,* v. 73, Feb. 1958, p. 102-103.

Factors considered include metal to be cut, tool material used, type of operation, quantity of production and cost. (G17, NM-h)

152-G. How to Cut Stamping Costs. *Steel,* v. 142, Feb. 3, 1958, p. 122-124.

Designing for standard practices and tolerances. (G3, 17-51, 17-55)

153-G. (Russian.) **Threading Tubes With Round Screw Dies.** I. A. Gurin. *Metallurg,* Dec. 1957, p. 31.

Semi-automatic machines for threading oil pipes, 6-13 in. diameter, equipped with special conical chuck. (G17f, 1-52, 4-60)

154-G. Behavior of Cutting Fluids in Reaming Steels. L. V. Colwell and Henrik Branders. *American Society of Mechanical Engineers,* Paper no. 57-A—168, Dec. 1957, 5 p.

(G17e; ST, NM-h)

155-G. Use of Shot Peening to Reduce Weight. W. R. Berry. *Institution of Mechanical Engineers, Proceedings of the Automobile Division,* no. 7, 1955-1956, p. 219-232.

Study of fatigue properties in the finite life range of the commercial silico-manganese spring steel leaves in the normal and shot-peened conditions so as to consider possibility of employing shot-peening as a means of using higher calculated stresses in laminated spring design, thus reducing weight of springs. 5 ref. (G23n, Q7; AY, *Si, Mn,* SGA-b)

156-G. Automatic Flame Profiling of Steel Plate. *Process Control and Automation,* v. 5, Jan. 1958, p. 22-24.

Experimental computer-controlled cutting machine, using magnetic tape input. (G22g; ST, 18-74)

157-G. Chem-Milling Comes of Age. Raymond L. Lewis. *Wisconsin Engineer,* v. 62, Dec. 1957, p. 30-32, 74.

(G24b)

158-G.* (French.) **Oxy-Acetylene Cutting of A52 Steels.** W. Soete and E. Sellier. *Revue de la Soudure,* v. 13, no. 4, 1957, p. 214-226.

Oxy-acetylene cutting of six A52 steels (in thicknesses of 8 to 25 mm.) caused no defects in cut edges. Process hardens the metal. No post-cutting treatment is required prior to welding. Ductility of cut edges is lower than that of metal before cutting, and a pre or post-heating by torch improves ductility. Where a cut edge is to be subjected to strenuous cold deformation, a grinding operation to remove from 1.0 to 1.5 mm. of material is recommended. (G22g, Q23p; AY)

159-G. One Ball, No Errors. *Automatic Machining,* v. 19, Feb. 1958, p. 40-42.

Ballizing process with precision balls of tungsten carbide and chromium alloy steel is solution for hole size and finishing problems. (G17d, G23n, 1-52; AY, W, 6-69)

160-G. How to Get More From Your High Production Machines. Harry Conn. *Machine and Tool Blue Book,* v. 53, Feb. 1958, p. 113-135.

Concept of "optimation" combines economics, metal cutting research and tool engineering to compute minimum cost, tool life, optimum speeds and feeds, and reduce down time due to tool changes. (G17, T6n, W25)

161-G. Today They Grind Titanium Routinely. D. S. Foote. *Machine and Tool Blue Book,* v. 53, Feb. 1958, p. 136-140.

(G18; Ti)

162-G. Growing Versatility of Ultrasonic Machining. Jack Welch. *Machinery,* v. 64, Feb. 1958, p. 119-123.

Most successful with harder, more brittle materials difficult to machine by other methods, such as carbide, ferrite, ferramic. Useful in manufacture of dies for type and tread designs for automobile tire molds; machining gem stones; hand engraving; slicing and dicing of Si and Ge for transistors and diodes. (G24c)

163-G. Practical Tooling for Cold Extrusion. Pt. 1. Special Report. John Verson. *Metalworking Production,* v. 102, Jan. 17, 1958, p. 105-113.

Factors for successful impact extrusion of steel; tool design, capacity of press, quality of material, lubrication and shape of slug, knowledge of metal flow. (G5, 1-52, ST)

164-G. Bending Machines Form Precision Parts. *Steel,* v. 142, Feb. 10, 1958, p. 79-82.

Various machines bend thin or heavy wall tubes, intricately flanged extrusions and other shapes to tight radii without wrinkling, bursting or distortion. (G6, 1-52; ST)

165-G.* (German.) **Ceramic Tools for Machining.** H. Opitz and H. Siebel. *Werkstattstechnik,* v. 48, Jan. 1958, p. 2-6.

Applications of ceramic cutting tools in working steel and cast iron. Advantages of some ceramic types in comparison with hard metal, especially in machining gray cast iron. (G17; SGA-j, Al, 6-70)

166-G. (Italian.) **Metallurgy and Machinability of Steels.** Ferruccio Grandi and Athos Masi. *Ingegneria Meccanica,* v. 6, Nov. 1957, p. 17-24.

Influence of hardness, mechanical properties, microstructure, composition, austenitic grain size, heat treatment and cold work on machinability. (To be continued.) (G17k; ST)

167-G.* **Hot Forming Operations on Titanium.** *Australasian Manufacturer,* v. 42, Jan. 11, 1958, p. 44-47.

Intricate contours and small-radius bends can be formed. The key to successful processing is controlled heating to temperatures from 300 to 1400° F., depending on the shape of the finished workpiece and the forming method employed. Individual heating blocks may be used to raise the temperature of the work by a few hundred degrees, or the work itself serves as a resistance heating element and is brought to a red heat. (G1, G9, 1-66; Ti)

168-G. Material Selection for Thread and Form Rolling. *Machine Design,* v. 30, Jan. 23, 1958, p. 137-143.

Rollability and machinability of carbon and alloy steels; nonferrous alloys, Al and Al alloys; finishes obtainable on threaded parts. (G11, G12, G17k, 17-52; ST, Al)

169-G. Carbide Tools of Special Form for Interrupted Cutting. M. G. Jensen. *Machinery,* v. 92, Jan. 3, 1958, p. 17-18.

Alteration of the normal tool form to include a positive top rake in conjunction with an edge chamfer resulted in satisfactory work finish, accuracy and a saving of time, by comparison with alternative methods of turning with high-speed steel or circular milling. (G17a, G17b, T6n; 6-69)

170-G. Turbine Blades Reclaimed by Electrolytic Grinding. E. W. Denison and C. V. Ruehrwein. *Machinery,* v. 92, Jan. 3, 1958, p. 31-32.

Cracks on the root flat of turbine blade dovetails have been removed, without altering the depth of penetration, by the electrolytic grinding process using a surface grinder with a 150-grit diamond electrode wheel and electronic control equipment. (G18, T7h)

171-G. Aircraft Manufacturing Practice—a Review of the British Industry. L. G. Burnard. *Machinery,* v. 92, Jan. 3, 1958, p. 37-47.

Types of routing machines and their applications, including three-dimensional contouring of integrally stiffened forms; wing skin milling; machining of high-tensile steels, Ti, etc., with results obtained using Strasman cutters; systems of numerical control for machine tools. (G17, T24a)

172-G. (Italian.) **Coining.** Franco Peruzzoti. *Rivista di Meccanica,* Jan. 21, 1957, p. 9-13.

Process; ferrous metals that can be successfully coined; machines used (fly press, toggle press); die design and specifications. (G3n, 1-52; CI, ST)

173-G. (Book.) **Metal Cutting Tool Nomenclature.** 107 p. 1958. Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. $4.50.

Definitions, illustrations and nomenclature arranged by classification. (G17, T6n, 11-67)

H Powder Metallurgy

43-H. (German.) **Electrolytic Production of Metallic Powder.** Wladislaw Tabor. *Chemische Technik,* v. 9, Nov. 1957, p. 645-649.

Electrowinning of Cu, Ni, Fe and Ag powder. (H10b; Ag, Cu, Fe, Ni)

44-H. (German.) **Substitution of Iron-Nickel Binder for Cobalt in Sintered Hard Metals.** R. Hohlesmann and R. Wehner. *Die Technik,* v. 12, Nov. 1957, p. 736-740.

Exchange is possible without a decrease in hardness, toughness and wearing resistance of alloy. 11 ref. (H15; SGA-q, *Fe, Ni, Co*)

45-H. (German.) **Powder Metal Parts.** Gerhard Zape. *Feinbearbeitung,* v. 23, 1957, p. 1-84.

Manufacture of powder metals, their properties and applications. (H general)

46-H.* **Production and Uses of Aluminium Powder and Paste.** V. J. Hill. *Metallurgia,* v. 57, Feb. 1958, p. 75-78.

Methods for production of finely divided Al. Properties and applications of both granular and flake forms, with particular reference to the influence of flake size and shape and of the choice of vehicle on the characteristics of Al paints. 4 ref. (H10, T29c, 17-57; Al)

47-H. (English.) **Sintered Beryllium. Pt. 2. Test Making of Beryllium Plate.** Hiroshi Nakatani and Tsuneo Narikawa. *Electrotechnical Laboratory, Bulletin,* v. 21, Dec. 1957, p. 881-884.

Fabrication of ductile Be by powder metallurgy methods, applying small compacting pressure. The density of sintered specimens is 95% of theoretical value. (H14; Be)

48-H. (Hungarian.) **New Industrial Permanent Magnet Materials.** Ferenc Bartfai. *Kohaszati Lapok,* v. 12, July 1957, p. 311-316.

Production of micro and other magnets by powder techniques. 22 ref. (H-general, T1; SGA-n)

49-H. **Sintered Metals Approach Properties of Wrought Alloys.** *Iron Age,* v. 181, Jan. 23, 1958, p. 88-90.

Low-cost grades of commercial iron powders are converted by single press-sinter operation into high-stress parts which would cost four times as much if machined with present methods. (H14, H15, Fe, ST, SS)

50-H.* (German.) **Production and Properties of Semifinished Tantalum Products.** Jiri Vacek. *Neue Hütte,* v. 2, Nov. 1957, p. 692-702.

Pressing of Ta powder; sintering; vacuum and temperature measurement; spectral analysis of the gases; vacuum installation; deformation of the sintered bars; waste treatment. 21 ref. (H-general; Ta)

51-H. (German.) **Theory and Practice of Soviet Powder Metallurgy.** W. S. Rakowski. *Neue Hütte,* v. 2, Dec. 1957, p. 764-767.

Study of sintering process with aid of isotopes; influence exerted by sound oscillations; large porous iron railway bearings. (H15n, T7d; Fe, 6-71)

52-H.* (German.) **Manufacture and Properties of Sintered Stainless Steel.** Friedrich Eisenkolb. *Stahl und Eisen,* v. 78, Feb. 6, 1958, p. 141-148.

Powders made from 18-8 steel by intergranular disintegration, atomization and jet atomization. Grain size, shape, pressing and sintering characteristics. Effects of pressure, sintering time and temperature, furnace gases, addition of 0.1-0.3% boron, 1.0-1.5% red phosphorus and 0.1-0.6% phosphorus from ferrophosphorus. Corrosion. Mechanical properties of powder of different grain size and of compacts containing 25% Ni. 26 ref. (H10, H14, H15, Q-general; SS)

53-H.* (German.) **Effect of Boron on Formation of Liquid Phases in Sintered Steel.** Friedrich Benesovsky and Werner Hotop. *Stahl und Eisen,* v. 78, Feb. 6, 1958, p. 149-152.

Mechanical properties and structure of samples, sintered 1 hr. at 1100° C., made of carbonyl, Hametag, sponge and RZ iron powders prepared with 0-10% alloy containing 0.3% C, 3.4% Si, 4.2% B, 18% Cr, 2.1% Fe and 72% Ni. Mechanical properties of samples sintered 2 hr. at 1250° C., made of steel containing 18% Cr, 8% Ni, with 0-10% Ni-Cr-B alloy. Scaling resistance. 11 ref. (H15, Q-general, R2q, 2-60; ST, AY, *B*)

J Heat Treatment

99-J.* **Automation in Heating and Quenching.** Norbert K. Koebel. *Metal Progress,* v. 73, Feb. 1958, p. 72-78.

Whether the part in mass production be a knitting needle, a gear or a ship plate, automatic line-ups of heat treating equipment can deliver a steady stream of product of superior uniformity meeting strict specifications for dimension, surface, and strength. (J-general, W27, 18-74)

100-J. (German.) **Hardening in the Job Shop.** W. Ordinanz. *Technica,* v. 6, Nov. 1957, p. 1357-1361.

(To be continued.) (J28, 18-67; ST)

101-J.* **Principles and Application of Heat Treatment for Titanium Alloys.** A. J. Griest and P. D. Frost. *Battelle Memorial Institute, TML Report no.* 87, Dec. 27, 1957, 132 p.

Relationships between alloy constitution, microstructure and properties obtained on heat treatment. Properties for selected commercial alloys in the heat treated condition; room-temperature and short-time elevated-temperature data; impact energy, creep, stress stability, fatigue and hardenability data; heat treating practice, including furnace characteristics, coatings for minimizing contamination and procedures for the control of distortion and flatness during heat treatment. (J-general, Q-general; Ti)

102-J. **Russia Looks at Induction Hardening, Forming.** K. Z. Shepelyakovskii. *American Machinist,* v. 102, no. 3, Feb. 10, 1958, p. 118-121. (From *Avtomobilnaya I Traktornaya Promishlennost.)*

Problems solved in induction heat treatment of gears. Induction heating used in forging ball bearings, stamping valves and rolling gears. (J2g, F21b, T7a; ST)

103-J.* (French.) **Heat Treatment of a Cupro-Aluminum.** *Journal d'Informations Techniques des Industries de la Fonderie,* no. 92, Nov-Dec. 1957, p. 11-13.

Problem of raising Brinell hardness of cupro-aluminum castings to around 240 while maintaining elongation at minimum of 10%. Dilatometric study revealed temperature of total transformation of alloy to be 980° C. On this basis, heat treatment was devised to provide required mechanical characteristics in specimens; comprises (a) heating to 700° C. and holding at this temperature for 2½ hr., followed by cold water quench, (b) tempering at 400° C. for 4 hr., followed by slow cooling. Figures are subject to revision in function of sizes of actual parts. (J26, J29; Cu, Al)

104-J.* **Quenching and Quenching Media.** B. F. Russell. *Australasian Engineer,* v. 50, Jan. 7, 1958, p. 70-79.

General discussion of steel quenching, transformation theory and hardenability. Oils, salt baths, marquenching, subzero cooling and air hardening. 22 ref. (J26, W28p, 1-52)

105-J. (German.) **Surface Treatment of High-Speed Steel Tools.** H. D. Weckener. *Werkstatt und Betrieb,* v. 91, Jan. 1958, p. 33-38.

38 ref. (J28; TS-m)

106-J.* (German.) **Experiences With Flame Hardening in a Hardening Shop.** R. Jonsson. *Werkstattstechnik und Maschinenbau,* v. 47, Nov. 1957, p. 610-615.

Basic aspects of planning. Choice of materials and examples of work types. Calculation of prime costs. (J2j, 17-53)

107-J.* (German.) **Problem of Measurement and Control in a Hardening Department.** O. Schaaber. *Werkstattstechnik und Maschinenbau,* v. 47, Nov. 1957, p. 630-635.

Measurement and control of temperature, heating and cooling speed, carbon potential, carbon transition time and gas composition during carburizing. (J28)

K Assembling and Joining

174-K. **Bonding Ceramics to Metal. Pt. 2.** A. E. Williams. *Ceramics,* v. 9, Dec. 1957, p. 26-30.

Methods of bonding ceramic materials in pipe systems and filtration processes. (K11b)

175-K. (German.) **Submerged-Arc Welding.** M. Komers. *Schweisstechnik,* v. 11, Sept. 1957, p. 97-100.

The metallurgical processes involved in forming a weld depend upon the powdered flux and the bare wire electrode used in unshielded welding. Proper selection improves the mechanical properties of the weld. Materials listed; application and economy in the re-use of flux. (K1e, W29h, W29j, 1-52)

(*)Articles Available Through Photocopy Service; See Coupon, p. 62

176-K. Welded Castings Keep Turbines Humming. Robert N. Williams. *Industry and Welding,* v. 31, Feb. 1958, p. 36-37, 60.
(K1e, W11k, 17-57)

177-K. Dip Braze Your Aluminum Assemblies. James W. Maston. *Industry and Welding,* v. 31, Feb. 1958, p. 38-39, 60.
(K8n; Al)

178-K. Ultrasonic Welding Without Fusion. *Industry and Welding,* v. 31, Feb. 1958, p. 54, 56-57.
(K6r)

179-K. (German.) **Measuring Techniques in Resistance Welding.** Otto Gengenbach. *Schweissen und Schneiden,* v. 10, Jan. 1958, p. 1-12.
Characteristics; measurement of currents, electrode pressure and other parameters. 11 ref. (K3, K9r)

180-K. (German.) **Control Devices for Single and Multiple Operation in Resistance Welding.** Heinz Neumann. *Schweissen und Schneiden,* v. 10, Jan. 1958, p. 12-15.
(K3, W29c)

181-K. (German.) **Control Equipment for Continuous Seam Welding.** Albert Gericke. *Schweissen und Schneiden,* v. 10, Jan. 1958, p. 15-20.
5 ref. (K3p, W29c)

182-K. (Italian.) **Report on the Dynamic Behavior of Direct Current Rotary Arc Welding Machines. Fourth Group of Experimental Tests.** Antonio Carrer. *Rivista Italiana della Saldatura,* v. 9, Sept-Oct. 1957, p. 201-226.
Conclusion. (K1, 1-52)

183-K. Brazing Strip Eliminates Rejects. *Steel,* v. 142, Feb. 10, 1958, p. 83-84.
Prediffused to ferrous or nonferrous strip, Ag brazing alloy doesn't run on heating. The braze is continuous, uniform and covers the entire joint area. (K8, Q27a, Ag, SGA-f)

184-K. Aluminum Dip Brazing Produces Strong, Clean Assemblies Rapidly at Low Cost. M. E. James. *Western Metalworking,* v. 16, Jan. 1958, p. 41-43.
(K8n, T24b, T1c; Al)

L Cleaning Coating and Finishing

200-L. Glass Coatings Fight Corrosion. *Ceramic Age,* v. 71, Jan. 1958, p. 16-18.
(L29; NM-f42)

201-L. Copper Plating From the Pyrophosphate Bath. Pt. 1. S. K. Panikkar, R. P. Singh and T. L. Rama Char. *Electrochemical Society, Bulletin (India Section),* v. 6, Oct. 1957, p. 69-73.
12 ref. (L17a; *Cu*)

202-L. Equipment for Automatically Coating Washing Machine Tubs With Slip. J. H. Bauer. *Machinery,* v. 92, Jan. 10, 1958, p. 79-80.
(L27, 1-52, 18-74; NM-g34)

203-L. Damage by Uncontrolled Shot Blasting. Konrad Kornfeld. *Metal Progress,* v. 73, Feb. 1958, p. 92.
(L10c)

204-L. Painting Structural Steel. G. M. Hamilton. *South African Mechanical Engineer,* v. 7, Oct. 1957, p. 55-69.
(L26n; ST)

205-L. Mechanical Descaling and Drawing of Mild Steel Rods. L. Marsden. *Wire Production,* v. 6, Oct. 1957, p. 5-12.
(L10, F27; CN)

206-L. (German.) **Nonmetallic Inorganic Protective Films.** G. Elssner. *Metallwaren-Industrie und Galvanotechnik,* v. 48, Aug. 1957, p. 324-327.
Processing and purpose of phosphate, chromate and oxide films on Fe, Zn, Al and Mg.
(L14a, L14b, L14c; Al, Fe, Zn, Mg)

207-L. (German.) **Indium Plating.** T. E. Brehmer and P. Alha. *Metallwaren-Industrie und Galvanotechnik,* v. 48, Aug. 1957, p. 339-345.
13 ref. (L17; *In*)

208-L. (German.) **Phosphate Film on Metal Surface Improves Cold Work and Reduces Mechanical Friction.** H. Keller. *Metallwaren-Industrie und Galvanotechnik,* v. 48, Oct. 1957, p. 443-447.
(L14b)

209-L. (German.) **Filtration and Purification of Chromium Baths.** W. Machu. *Metallwaren-Industrie und Galvanotechnik,* v. 48, Dec. 1957, p. 506-511.
(L17; *Cr*)

210-L. (German.) **Fully Automatic Plating of Brass and Bronze Armatures.** E. Lutter. *Metallwaren-Industrie und Galvanotechnik,* v. 48, Dec. 1957, p. 512-515.
A working plan is suggested for high-luster Ni and Cr plating. A fully automatic machine reduces operational costs while increasing uniformity and quality of the coating.
(L17, 1-52, W11q, 18-74; Ni, Cr, Cu-n, Cu-s)

211-L. (German.) **Metallic Coatings on Nonconductors (Plastics).** O. P. Krämer. *Metallwaren-Industrie und Galvanotechnik,* v. 48, Dec. 1957, p. 516-520.
The metallization of plastics combines the advantages of both. Metallic coating protects plastics against mechanical and chemical influences. Five groups of preliminary treatment discussed. (L23; NM-d)

212-L. (German.) **Influences Upon the Structure of Electroplate.** P. Lenhard. *Metallwaren-Industrie und Galvanotechnik,* v. 48, Dec. 1957, p. 528-535.
Influence of electrolyte, hydrogen, working conditions, colloids and other organic matter, after-treatment, heat, basic material, nonmetals, metallic foreign bodies, formation of alloys during electroplating. (L17, N12d)

213-L. Relationship Between Hydrogen Solubility and Reboiling Tendency in Enameling Steels. R. M. Hudson, J. K. Magor and G. L. Stragand. *American Ceramic Society, Journal,* v. 41, Jan. 1, 1958, p. 23-27.
9 ref. (L27, 9-71; ST, *H*)

214-L. Extrusion Cladding of NRU Fuel Elements. H. S. Milne. *Atomic Energy of Canada,* CRE-701, Apr. 1957, 35 p.
Vertical hydraulic press forces preheated Al billets into a converging chamber of a die-block arrangement. Metal flows around the core material and welds into a continuous sheath over the core as the core is guided horizontally through the die.
(L22; Al, U)

215-L. Study of the Oxidation of Steel Plate as Related to Wettability and Adherence of Porcelain Enamel. Henry P. Still, Jr. *Ceramic Society Bulletin,* v. 37, Jan. 1958, p. 22-26.
Quick test to predict enamel behavior on steel plate without performing actual enameling operation. Adherence was correlated with oxidation. No relationship found between wettability and oxidation or adherence. 7 ref.
(L27, Q10c; 4-53, ST)

216-L. New Chemical Process Plates Resistant Nickel. *Chemical Engineering,* v. 65, Jan. 13, 1958, p. 172-174.
Niphos process chemically plates uniform Ni coat on complicated parts impossible to electroplate. Coat is hard, ductile and nonporous.
(L28; *Ni*)

217-L. Nickel Protection for Ferrous Metals. *Design Engineering,* v. 4, Feb. 1958, p. 72.
The coating is heated in a reducing atmosphere to provide a tightly adhering Ni-alloy cladding that will not peel or flake. (L22; ST, *Ni*)

218-L. Effectiveness of Various Protective Coverings on Magnesium Fins at Mach Number 2.0 and Stagnation Temperatures up to 3600° R. William M. Bland, Jr. *National Advisory Committee for Aeronautics, Research Memo,* Jan. 9, 1958, 48 p.
(L22, 2-62; Mg, *Ni*)

219-L. Protection of Metals With Tannins. E. Knowles and T. White. *Oil and Colour Chemists' Association, Journal,* v. 41, Jan. 1958, p. 10-23.
Tannin extracts found of value in protecting ferrous metals from atmospheric and underground corrosion; use as wash-primers before painting. Solutions of tannin extracts lay down insoluble weather-resistant ferric tannate on ferrous metal surface. 11 ref.
(L26n, 4-60; ST, CI, NM-g35)

220-L.* (French.) **Special Application of Oxy-Acetylene Flame Descaling to the Preparation of Standard Rolled Products for Subsequent Spot Welding.** M. Evrard. *Revue de la Soudure,* v. 13, no. 4, 1957, p. 195-210.
Best operating conditions in terms of flame power, feeds and force of water jet, with an eye at all times to shop costs and quality of assemblies ultimately executed, were determined by measurement of contact resistances in descaled products. Special series of tests in which descaling was done by other methods (sand blasting, shot blasting, grinding, chemical descaling) showed that best results in cleaning and subsequent spot welding are obtained by flame descaling. (L10g, K3)

221-L. Internal Burnishing. Lewis Bussey and Walter Vote. *Automatic Machining,* v. 19, Feb. 1958, p. 53-54.
Proper burnishing on multiple spindle automatic screw machine requires smooth reamed hole and secure spindle, slide and tool. Method may replace grinding operation.
(L10b, W25, 1-52; ST)

222-L.* Leveling in Cyanide Copper Solutions — a Further Study. Barnet T. Ostrow and Fred Nobel. *44th Annual Technical Proceedings, American Electroplaters' Society,* 1957, p. 24-28.
With addition agents, modified cyanide copper bath levels and plates regardless of degree of roughness of base metal. The amount and kind of leveling and plating obtained compare favorably with that secured from present-day leveling Ni solutions plus ability to plate Zn die castings directly. 6 ref.
(L17; ST, Cu, Zn, *Ni*)

223-L.* Bright and Semi-Bright Crack-Free Chromium. E. J. Seyb, A. A. Johnson and A. C. Tulumello. *44th Annual Technical Proceedings, American Electroplaters' Society,* 1957, p. 29-35.
Properties of the bright crack-free Cr deposit in comparison with the usual Cr deposits. Corrosion results

See Coupon, p. 63.

with the regular salt spray, acetic acid salt spray, Corrodkote and outdoor exposure. 13 ref.
(L17a, 9-72; *Cr*)

224-L.* Electroplating on Nickel and Nickel Alloys. W. W. Sellers and C. B. Sanborn. *44th Annual Technical Proceedings, American Electroplaters' Society,* 1957, p. 36-41.

Four basic steps are an electroplating bath, mechanical preparation, degreasing and cleaning, and activation of the basis metal. Various Ni plating baths which may be used—the Watts-low pH, Watts-high pH, chloride-sulphate, chloride, hard Ni, basic sulphamate, sulphamate plus Cl (-), and the fluoborate baths. Nominal composition, operating conditions, physical characteristics and mechanical properties of the Ni deposits.
(L17; Ni)

225-L.* Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating. Pt. 4. The Effect of Different Ferrous Metals on the Performance of a Watts Nickel Deposit. AES Research Project No. 14. M. H. Jones, Chih-Yeu Lu and J. Zajdowski. *44th Annual Technical Proceedings—American Electroplaters' Society,* 1957, p. 53-69.

Test results on durability of Watts Ni deposit on various ferrous metals shows that there are significant differences between performance of certain metals with deposits of 0.0005 and 0.0001 in. These differences are considerably less at higher plate thicknesses. There is a basic corrosion rate which is determined by deposit thickness rather than the composition of basis metal.
(L17c, 3-69; *Ni*, Fe, ST)

226-L.* Get Parts Cleaner by Ultrasonics. Norman G. Branson. *Materials in Design Engineering,* v. 47, Feb. 1958, p. 118-121.

Basically the technique consists of an ultrasonic generator, a transducer, a cleaning fluid and a tank. Widely varying frequencies, different types of transducers and various cleaning fluids. (L10f)

227-L. Textured Steel Metallized in Color. *Metalworking,* v. 14, Feb. 1958, p. 8-9.

Combination vacuum metallizing and enameling process creates a brilliant corrosion resistant finish in any color. Inexpensive finish will replace electroplating in many fields.
(L23, L27, 1-73; ST, Al)

228-L. Rolling Improves the Finish, Hardens the Surface. *Metalworking,* v. 14, Feb. 1958, p. 10-11.

(L10b; CI)

229-L. Pack Chromizing Method Hikes Heat, Wear, Corrosion Resistance on Varied Components. Maurice C. Commanday. *Western Metalworking,* v. 16, Jan. 1958, p. 46-48.

Method allows application of inexpensive materials for use of gas stove radiants, gas turbine components, heat treat fixtures and piercing dies. Depth of Cr diffusion depends on carbon content of base metal. (L15, W28, 17-57; CI, ST, *Cr*)

230-L. Tumbling Methods Boost Output 3 to 5 Times; Cuts Manpower, Production Costs. Ron Wilke. *Western Metalworking,* v. 16, Jan. 1958, p. 52-54.

(L10d)

231-L.* (German.) **Removability of Scale From Steel Sheet.** Wilhelm Rädeker and Max Wild. *Stahl und Eisen,* v. 78, Jan. 23, 1958, p. 100-103.

Scale removal from sheet (rolled from rimming steel killed by Si and Si and Al) by pickling, sand blasting, burning and natural weathering. Effects of final rolling temperature and method of casting. Comparison of results with structure and adhesiveness of scale.
(L10c, L12g; ST, 4-53, 9-52)

232-L.* Effects of Plating High Tensile Strength Steels. Walter Beck and Edward J. Jankowsky. *American Electroplaters' Society 44th Annual Technical Proceedings,* 1957, p. 47-52.

C-ring test furnishes quick, semi-quantitative information concerning susceptibility of stressed high-strength steel tube specimens to cracking during and after electroplating. Stressed C-ring stimulates high-strength steel part with surface in state of high residual tensile stress, and will crack during Cd or Cr plating from cyanide or chromic acid bath. Time to cracking is extended considerably when prestressed rings are Cd plated from fluoborate instead of from cyanide bath. (L17c; ST, SGB-a, 9-72)

233-L. Vapor Deposition of Molybdenum and Niobium Coatings on Stainless Steel Tubes. Carroll F. Powell, Danny M. Rosenbaum, Robert B. Palmer and Ivor E. Campbell. Battelle Memorial Institute. *U. S. Atomic Energy Commission,* BMI-1228, Oct. 2, 1957, 8 p. (Available at U. S. Office of Technical Services, $.50.)

(L25k; *Cb, Mo,* SS)

234-L.* (German.) **Flame Spraying of Nonmetallic Protective Coatings on Metal Surfaces.** H. Reiniger. *Metalloberfläche,* v. 11, Dec. 1957, p. 393-400.

Preparatory treatment of adhesive base; various types of sprayers; materials suitable for spraying and influence of additions (polyisobutylene, stearates). Preparation of spray powders, properties and applications.
(L26, W4g)

235-L. (German.) **Control of Anodizing by Voltage Regulation.** R. Lattey. *Metallwaren-Industrie und Galvanotechnik,* v. 49, Jan. 1958, p. 11-13.

In all baths for anodic coating, measurement of voltage alone does not indicate thickness of layer to be expected. Thickness is determined primarily by the product of current density and time. (L19, S18)

236-L. (German.) **Pickling of Copper and Brass.** M. Straschill. *Metallwaren-Industrie und Galvanotechnik,* v. 49, Jan. 1958, p. 20-23.

(L11g; Cu, Cu-n)

237-L. (German.) **Successful Application of Burnishing.** O. Melzer. *Werkstatt und Betrieb,* v. 91, Jan. 1958, p. 49.

(L10b)

Metallography

Constitution and Primary Structures

134-M. Alloys of Silicon With Palladium and Silver. N. Kondal Rao and H. Winterhager. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 139-148.

Two new alloys and considerable alterations proposed in Pd-Si system; no solid solubility of Ag in Si; immiscibility loop in the ternary system. 7 ref.
(M24b, M24c, N12p; Si, Pd, Ag)

135-M. Oxide-Replica Technique for Electron-Microscopy of Duralumin. D. L. Bhattacharya and K. S. Grewal. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 149-155.

Thicker oxide coating than usual is necessary; specimens stripped by amalgamation with mercury. 7 ref.
(M20r; Al)

136-M. X-Ray Diffraction of Alpha Brass. K. Gupta, P. Basak and G. P. Chatterjee. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 157-161.

Progressive dezincification in vacuum. (M22g; R2k, Cu-n)

137-M. X-Ray Diffraction Studies of Gold-Beryllium Alloys. G. P. Chatterjee. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 163-167.

Crystal structure and density of $AuBe_5$. (M22g, M26; Au, *Be*)

138-M. Preferred Orientations in Cold Drawn Face-Centered Cubic Metal Wires. P. Dayal. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 201-210.

Determination of fiber texture developed in wires of Cu, Ni, Al, Ag and Au drawn to 97.5% reduction in diameter. 29 ref. (M26c, M22g, Q24a; Cu, Ni, Al, Ag, Au, 4-61)

139-M.* Zonal-Texture of Drawn Face-Centered Cubic Metal Wires. P. Dayal. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 211-222.

Variation in texture of drawn wires of Cu, Ni, Al, Ag and Au from the surface to their core. Tensile strength and resistivity are affected by nonuniformity in texture across the cross-sections. New method to measure degree of orientation from surface to core. 19 ref.
(M26c, Q27a, P15g, M22g; Cu, Ni, Al, Ag, Au, 4-61)

140-M. Effect of Oxygen on Etch-Pit Formation in Silicon. R. A. Logan and A. J. Peters. *Journal of Applied Physics,* v. 28, Dec. 1957, p. 1419-1423.

(M20q; Si)

141-M. (German.) **Development of Metalloid-Containing Phases in Alloys.** H. Nowotny and A. Wittman. *Radex Rundschau,* no. 5-6, 1957, p. 693-707.

X-ray investigation of metal-metalloid phases in the system UC-ZrC, UC-CbC and UC-TaC; influence of C, B, N and O on the phases. 39 ref. (M24c, M26r, U, Zr, Ta, Cb, C)

142-M. (German.) **Oxidation Figures on Metal Surfaces.** S. Yamaguchi. *Werkstoffe und Korrosion,* v. 8, Dec. 1957, p. 733-735.

Microscopic investigations demonstrate oxide layers are genuine oxidation figures, enabling lattice-type determination. 5 ref. (M26r, Rlh)

143-M. (Hungarian.) **New, Simple and Quick Process for Determination of Grain Size of Iron Alloys.** Ferenc Boda. *Kohaszati Lapok,* v. 12, June 1957, p. 246-249.

4 ref. (M27c; Fe)

144-M. (Russian.) **Peculiarities of Surface Structure of Decarburized Castings of Malleable Iron.** M. A. Krishtal, I. P. Fominykh and A. Ya. Tseitlin. *Liteinoe Proizvodstvo,* Aug. 1957, p. 22-23.

Defect formation on surface of malleable iron castings on annealing. 8 ref.
(M28p, J23, 9-71; CI-s)

145-M.* Constitution of Rhenium-Molybdenum Alloys. J. M. Dickinson and L. S. Richardson. *American Society for Metals, Transactions,* v. 51, Preprint no. 72, 1957, 18 p.

Two intermediate phases, sigma and chi, were found. Sigma undergoes a peritectic decomposition at 2645° C. and chi undergoes a peritectoid decomposition at 2080° C.

(*)Articles Available Through Photocopy Service; See Coupon, p. 6

There is a eutectic at 2505° C. at 65 wt. % Re. Molybdenum dissolves up to 59% Re; Re dissolves up to 12% Mo. 4 ref. (M24b; Re, Mo)

146-M.* Electrolytic Migration of Carbon in Steels. William Hume-Rothery. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 113.

The view that carbon dissolved in austenite exists in the form of C + ions is criticized on the grounds of ionic radii and of the energies involved. It seems more probable that the carbon atoms are bound by forces resembling those of covalent linkages, and it is shown how this concept can be reconciled with the electrolytic migration data. 4 ref. (M25h; ST, *C*)

147-M. Localized Electrons in Body-Centred Cubic Metals. J. S. Griffith and L. E. Orgel. *Nature,* v. 181, Jan. 18, 1958, p. 170-172.

13 ref. (M25, M26)

148-M. (English.) **Lifetime Measurements of Minority Carriers Across and Along a Dislocation Wall in a Germanium Crystal.** Ryukiti R. Hasiguti and Etsuyuki Matsuura. *Physical Society of Japan, Journal,* v. 12, Dec. 1957, p. 1347-1351.

Recombination diameter of a dislocation in a dislocation wall was measured in n-type germanium. It is 2.2 x 10^{-8} cm. From this value a relation between lifetimes and densities of randomly distributed dislocations was obtained. 12 ref. (M26b, 14-61; Ge)

149-M. (English.) **Lifetime Measurements of Minority Carriers in Deuteron Irradiated Germanium Crystals.** Ryukiti R. Hasiguti, Etsuyuki Matsuura and Shiori Ishino. *Physical Society of Japan, Journal,* v. 12, Dec. 1957, p. 1351-1354.

Fictitiously long lifetimes were obtained which suggest the formation of a p-type thin layer by the deuteron irradiation. 5 ref. (M26b, 2-67, 14-61; Ge)

150-M. (English.) **New Oxidizing Method for Revealing Austenitic Grain.** Yunoshin Imai and Hiroshi Hirotani. *Tohoku University, Science Reports of the Research Institutes,* Series A, v. 9, Dec. 1957, p. 468-475.

Superiority of new oxidizing method using borax as compared to such techniques as thermal etching, fracture and martensitic etching. (M20s, M27c; ST)

151-M. (Hungarian.) **Dilatometric Determination of Retained Austenite.** Zoltan Csepiga. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 156-162.

Mathematical solution showing retained austenite in percent. 23 ref. (M23b, N8n)

152-M.* Micro-Constituents in Steels. K. W. Andrews and H. Hughes. *Iron and Steel,* v. 31, Feb. 1958, p. 43-50.

Electrolytic technique for isolating microconstituents, X-ray techniques for examination, application of the findings to five types of steel, tempered martensite, low-carbon, sigma phase, Cr-Mo-Ti, and Cr-Mo steels. 23 ref. (M23, M26r; ST, AY)

153-M. Grinding and Polishing Especially of Metallographic Specimens. Z. Ministr. *Industrial Diamond Review,* v. 18, Jan. 1958, p. 7-10.

(To be continued.) (M20p)

154-M. Etch Pits in Indium Antimonide. W. Bardsley and R. L. Bell. *Journal of Electronics and Control,* v. 3, July 1957, p. 103-105.

8 ref. (M20q; In, Sb)

155-M. Spiral Etch Pits in Germanium. R. G. Rhodes, K. O. Batsford and D. J. Dane-Thomas. *Journal of Electronics and Control,* v. 3, Oct. 1957, p. 403-408.

A technique using an iodine etching solution reveals a spiral terraced structure on Ge single crystals. 4 ref. (M20q, M26; Ge, 14-61)

156-M. Crystalline Perfection of Some Semiconductor Single Crystals. R. L. Bell. *Journal of Electronics and Control,* v. 3, Nov. 1957, p. 487-493.

12 ref. (M26; Ge, Si, 14-61)

157-M. Observation of Vacancy Sources in Metals. R. S. Barnes, G. B. Redding and A. H. Cottrell. *Philosophical Magazine,* v. 3, Jan. 1958, p. 97-99.

Grain boundaries are effective sources of vacancies, but twin boundaries are not. (M26s, M27f; Cu)

158-M.* New Data Concerning Uranium Alloys. *Soviet Journal of Atomic Energy,* v. 2, no. 6, 1957, p. 712-714. (Translated by Consultants Bureau, Inc.)

The U-Bi system studied metallographically and by X-ray diffraction, neutron diffraction and thermal analysis. Alloys containing up to 30% U were prepared in a graphite crucible at about 1300° C. from pieces of U and Bi (99.99%), the latter having been filtered through a porous Pyrex filter. Alloys with a higher U content were prepared from U powder and crushed Bi, the U powder being obtained by hydrogenation and dehydrogenation in the same graphite crucible in which the alloy was prepared. The system is of practical interest, since Bi is very fusible and has a low thermal neutron cross section, and U-Bi alloys may be used as liquid nuclear fuels. 5 ref. (M24b, 1-60; U, Bi)

159-M. (English.) **New Reagent for Microscopic Strain Analysis in Steel.** Ariel Taub. *Research Council of Israel, Bulletin,* v. 6C, Nov. 1957, p. 29-32.

A newly discovered Au reagent permits quantitative microscopic strain analysis of steel specimens. 8 ref. (M21c, M20q, Q25n, ST)

160-M. Diagrammatic Representation of the Texture Data for Drawn Materials. D. S. Eppelsheimer and K. K. Tangri. *University of Missouri, School of Mines and Metallurgy, Bulletin,* Technical Series 87, 1957, 3 p.

(M26c, G4)

161-M. X-Ray Diffraction Technique for Quantitative Determination of Texture Variation in Drawn Rods of Cubic Metals. D. S. Eppelsheimer and K. K. Tangri. *University of Missouri, School of Mines and Metallurgy, Bulletin,* Technical Series 87, 1957, 8 p.

(M21f, M26c, G4, 4-55)

162-M. (English.) **Crystal Structures of Zr_5Ge_3, Ta_5Ge_3 and Cr_5Ge_3.** Erwin Parthe and John T. Norton. *Acta Crystallographica,* v. 11, Jan. 1958, p. 14-17.

4 ref. (M26; Cr, Ge, Ta, Zr)

163-M. (German.) **Progress in Constitution Research.** H. F. Spengler. *Metall,* v. 12, Feb. 1958, p. 105-113.

Literature review covering 1956-1957 with reference to binary and multiple systems. 109 ref. (M24)

164-M.* Alloys of Aluminum, Thorium and Uranium. Gene E. Bobeck and H. A. Wilhelm. Iowa State College. *U. S. Atomic Energy Commission,* ISC-832, Dec. 1955, 26 p. (Available at U. S. Office of Technical Services, $1.)

The Al-rich corner of the ternary alloy system Al-Th-U investigated by thermal and microscopic analyses to determine an area of low-melting alloys that could be used as a liquid metal fuel in U_{233} breeder reactors. There is a rather wide range of compositions, varying from 13% U at 0% Th to 0% U at 25% Th, that can be maintained in a one-phase liquid solution at temperatures even lower than 640° C. 7 ref. (M24c, T11g, 17-57; U, *Al, Th,* SGA-d)

N Transformations and Resulting Structures

125-N.* Processes Occurring on Metal Surfaces During Cathode Sputtering. G. V. Spivak, V. E. Iurasova, I. N. Prilezhaeva and E. K. Pravdina. *Academy of Sciences of the U.S.S.R., Bulletin, Physical,* v. 20, no. 10, p. 1075-1081. (Columbia Technical Translations.)

Ionic etching aids investigations of structure of metals and alloys. 13 ref. (N15g, M20q)

126-N. Role of Phosphorus in Aging of Normalized Steels. T. V. Cherian and N. J. Wadia. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 83-93.

17 ref. (N7a, 2-60; Q29n, ST, *P*)

127-N. Effect of Silver on the Recrystallization Temperature of Electrolytic Copper. E. R. Chandrasekhar. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 95-102.

4 ref. (N5, 2-60; Cu-a, *Ag*)

128-N. Effects of Titanium on Aging Characteristics of Aluminum Copper Alloys. A. K. Chatterjee and G. P. Chatterjee. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 181-185.

Alloy with 2.1% Cu and 0.4% Ti shows good hardening. 8 ref. (N7a, 2-60; Al, *Cu, Ti*)

129-N. (German.) **Influence of Chemical Composition and Structure on Behavior of Hydrogen in Iron and Steel.** W. Wichmann. *Neue Hütte,* v. 2, Oct. 1957, p. 618-620.

(N1c, 2-60, 3-71; CI, ST, *H*)

130-N.* (German.) **Hydrogen in Iron and Its Behavior.** Michael Smialowski. *Neue Hütte,* v. 2, Oct. 1957, p. 621-626. (Henry Brutcher, Altadena, Calif., Translation no. 4082.)

Dilatation effects; diffusion coefficient at room temperature, influence of "layer of bubbles" on values of coefficient. Form of hydrogen in iron lattice. 28 ref. (N1c; Fe, H)

131-N. (German.) **Solubility of Gases in Nonferrous Metals.** Wilhelm Hofmann and Jürgen Maatsch. *Neue Hütte,* v. 2, Oct. 1957, p. 648-650.

Solubility of oxygen and hydrogen in Cu, Pb, Zn; behavior at melting point; porosity. 14 ref. (N15d, P12e, Cu, Pb, Zn, *O, H*)

132-N. (Russian.) **Some Characteristics of Diffusion of Magnesium in High-Strength Iron.** I. L. Mirkin and E. P. Rikman. *Liteinoe Proizvodstvo,* Dec. 1957, p. 13-16.

Various instruments and methods in studying microstructure of magnesium iron showing a laminated crystalline rather than uniform structure. 8 ref. (N1c, M27, 1-53, 1-54; Fe, *Mg*)

133-N.* Nature of Strain-Age Embrittlement. C. J. Osborn. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 97-101.

Embrittlement which occurs in steel during aging after plastic deformation can be studied conveniently by means of a notched-bar test. Curves showing the progress of em-

brittlement with time of aging a low-carbon iron at 30 and 80° C. closely resemble the corresponding strain-age hardening curves; it is suggested that both embrittlement and hardening are due to the same basic process. The activation energy for strain-age embrittlement is calculated to be of the order of 20,000 cal per mole, which is the same as for strain-age hardening. 16 ref. (N7e, Q26s; CN-g)

134-N. (English.) **Studies on the β-ε Transformation in Cobalt-Nickel Alloys. Pt. 1. Propagation Process of the Transformation.** Sakae Takeuchi and Toshio Honma. *Tohoku University, Science Reports of the Research Institutes,* Series A, v. 9, Dec. 1957, p. 492-507.

Optical microscopic study of transformation of the face-centered cubic into the close-packed hexagonal phase in Co and its alloys; process of growth of relief marking and its relation to the inner structure of transformed phase.
(N6p, M21e; Co, Ni)

135-N. (English.) **Studies on the β-ε Transformation in Cobalt-Nickel Alloys. Pt. 2. Microstructure of Transformation Relief.** Sakae Takeuchi and Toshio Honma. *Tohoku University, Science Reports of the Research Institutes,* Series A, v. 9, Dec. 1957, p. 508-519.

Mechanism of propagation of the face-centered cubic→close-packed hexagonal lattice transformation in Co-Ni alloy from the observation of the microstructure of relief, working with electronic microscope. 8 ref. (N6p, M21e; Co, Ni)

136-N. (English.) **Diffusion of Sulphur in Liquid Iron. Pt. 2. Diffusion in Liquid Iron Saturated With Carbon.** Yasuji Kawai. *Tohoku University, Science Reports of the Research Institutes,* Series A, v. 9, Dec. 1957, p. 520-526.

Diffusion coefficient was measured in 1390-1560° C. temperature range by using radioactive sulphur S^{35}. 10 ref. (N1a; Fe, *S*, 14-60)

137-N.* (French.) **Influence of Heterogeneous Stresses on the Allotropic Transformation of Cobalt.** Herve Bibring and Francois Sebilleau. *Comptes Rendus,* v. 245, Dec. 16, 1957, p. 2269-2271.

Specimen of pure, polycrystalline Co, previously polished, of hexagonal structure, was heated under vacuum to 500° C., at which point oxygen introduced into the vacuum chamber caused formation of an oxide film. After cooling to hexagonal state, oxide film exhibited appearance of a twinned cubic crystal. Film was removed and surface of metal again attacked, after which original hexagonal grain only was found. These phenomena suggest that under normal conditions transformation nuclei in Co are few, that heterogeneous stresses provoke multiplication of nuclei. Intentionally created quenching and cold working stresses favored nucleation, cubic crystal of the alpha phase gave rise to numerous disoriented hexagonal regions. (N6p, 3-66; Co)

138-N.* (French.) **Presentation of a Phenomenon of Regeneration of a Single Crystal of Alpha Iron Due to Preservation of Nuclei During Allotropic Transformation (Alpha-Gamma-Alpha).** Gerard Donze and Rene Faivre. *Comptes Rendus,* v. 245, Dec. 16, 1957, p. 2277-2280.

When a crystal of alpha iron containing impurities such as carbon and nitrogen is heated a little above its transformation temperature, it possesses the curious property of being regenerated upon cooling. Phenomenon is explained by assumption that nuclei of alpha iron are preserved in polycrystalline structure of gamma iron. 5 ref.
(N6p, N2; Fe, 14-61)

139-N. (French.) **Influence of Heat Treatment on the Aging of Pure Iron After Tempering and Deformation.** Bernard Migaud and Jean Talbot. *Comptes Rendus,* v. 245, Dec. 16, 1957, p. 2282-2284.
(N7a, 2-64; Fe-a)

140-N. (French.) **Establishment of Equilibrium Diagrams of Binary Alloys by Experiments in Intermetallic Diffusion. Application to the Uranium-Zirconium System.** Jean Philibert and Yves Adda. *Comptes Rendus,* v. 245, Dec. 23, 1957, p. 2507-2510.
(N1a, M24b; U, Zr)

141-N. (French.) **Growth of Large Perfect Crystals of Alpha Uranium Resulting From Cold Working and Annealing of Polygonized Monocrystals Produced by Phase Transformation.** Jean Mercier, Daniel Calais and Paul Lacombe. *Comptes Rendus,* v. 246, Jan. 6, 1958, p. 110-113.
8 ref. (N3r; U)

142-N.* (French.) **Study of the Kirkendall Effect and Determination of Coefficients of Chemical and Self-Diffusion in a Uranium-Molybdenum Couple.** Yves Adda and Jean Philibert. *Comptes Rendus,* v. 246, Jan. 6, 1958, p. 113-116.

Coefficients of chemical diffusion were determined at temperatures from 800 to 1050° C., and variations were plotted against concentration. Coefficients of self-diffusion were then calculated. Quantitative study was made of a clearly observed Kirkendall effect in the cubic centered phase of the U-Mo couple. 6 ref. (N1d; U, Mo)

143-N. (German.) **Hydrogen Solubility in Alloys.** H. Witte. *Neue Hütte,* v. 2, Dec. 1957, p. 749-756.
24 ref. (N15d, P12s, P12e, *H*)

144-N.* (Japanese.) **Grain Control of Low-Carbon Killed Steels.** Toyosuke Tanoue. *Sumitomo Metals,* v. 9, July 1957, p. 139-142.

Steels with up to 0.018% Al examined. No correlation between Al content and mean size of grain, but normality of grain distribution varied with Al content. Steels with less than 0.004% of soluble Al had normal grains, but those with more had mixed grains. Coarse steel making necessitates a limitation of Al content to under 0.004%. Fully killed steel requires silicon content over 0.20%. (N3, 2-60; CN-g, *Al*)

145-N.* (Japanese.) **Recrystallization and Aging of Aluminum-Beryllium Alloy.** Shiro Terai. *Sumitomo Metals,* v. 9, July 1957, p. 166-184.

Effects of Be on high-purity Al and alloys varied with presence of Fe and Si as impurities. Cast structures were refined; recrystallization temperature reduced for Al and Al with 1.2% Mn alloy. Grain size refined; alloys showed split aging effect, increased with Si, decreased with Cd. 20 ref.
(N5, N7a, 3-69; Al, *Be*)

146-N.* (Japanese.) **Grain Size of Copper Alloys.** Rihei Kawachi and Mutsumi Okawa. *Sumitomo Metals,* v. 9, July 1957, p. 185-194.

Effect of degree of prior deformation and annealing temperature on grain size of 70-30 brass and Albrac; isothermal grain growth; distribution of grain size along direction of thickness in sheet; grain size and stress-corrosion cracking; grain size and high-temperature tensile properties. 13 ref.
(N3, M27c, 3-68, 2-64; Cu)

147-N.* (English.) **Solid State Diffusion in the Reduction of Hematite.** John Olof Edström. *Jernkontorets Annaler,* v. 141, Dec. 1957, p. 809-836.

Solid state reduction of hematite to magnetite and wustite at 600-1200° C. Single crystal plates pressed between powdered iron and wustite as specimens were annealed. Hematite with iron yielded wustite and magnetite layers, with wustite gave magnetite layers alone. Rate constants and activation energies for reduction of Fe_2O_3 closely agree with gaseous reduction. Calculation of self-diffusion coefficients for iron in wustite and in Fe_3O_4. 78 ref.
(N1, D8; Fe)

148-N.* **Activity of Zinc Oxide in Lead and Copper-Crucible Slags Which Have Been Subjected to Fuming.** A. I. Okunev and V. S. Bovykin. *Academy of Sciences of the USSR, Proceedings, Chemistry Section,* v. 112, Jan-Feb. 1957, p. 13-15. (Translated by Consultants Bureau, Inc.)

In slags with less than 8% Zn, activity of zinc oxide is close to unity (0.95-0.97), and for less than 15% Zn, it decreases to 0.88-0.90.
(P12b; Pb, Cu, *Zn*, RM-q)

149-N.* **Recrystallization Diagram of Iodide (Process) Zirconium.** E. M. Savitsky and V. F. Terekhova. *Academy of Sciences of the USSR, Proceedings, Chemistry Section,* v. 112, Jan-Feb. 1957, p. 49-51. (Translated by Consultants Bureau, Inc.)

Based on the recrystallization diagram, annealing temperatures of 700-750° for cold worked Zr can be recommended. Complete reduction of the deformed structure (recrystallization conditioning) occurs, grain dimensions increase insignificantly, and the Zr articles are oxidized little at these temperatures, even during annealing in air.
(N5, J23; Zr)

150-N.* **Some Observations of the Effects of Oxygen on the Minority Carrier Lifetime and Optical Absorption of Silicon Crystals Pulled in Vacuo.** G. W. Green, C. A. Hogarth and F. A. Johnson. *Journal of Electronics and Control,* v. 3, Aug. 1957, p. 171-182.

Techniques and equipment for producing single crystals of Si by pulling from a melt in vacuo; some electrical characteristics of crystals so grown. The minority carrier lifetime decreases radially from the center of the crystals and this behavior is believed to arise from a difference in oxygen concentration, being greater near the axes of the crystals and smaller toward the edges. Optical absorption measurements, which indicate the relative concentrations of oxygen in Si crystals grown by various techniques, suggest that while there is a low concentration in vacuum-grown crystals, there is still a radial variation as postulated above.
(N3r, P15; Si, 14-61)

151-N.* **Anisotropic Diffusion Lengths in Germanium and Silicon Crystals Containing Parallel Arrays of Edge Dislocations.** R. L. Bell and C. A. Hogarth. *Journal of Electronics and Control,* v. 3, Nov. 1957, p. 455-470.

(*) Articles Available Through Photocopy Service; See Coupon, p. 6[illegible]

Techniques for introducing parallel arrays of edge dislocations into Ge and Si by means of plastic bending. Crystals of Ge with a similar arrangement of dislocations, but with a higher mean minority carrier lifetime than for those subjected to plastic bending, may be grown by pulling from the melt using a suitably orientated dislocated seed crystal. In crystals containing parallel arrays of edge dislocations the diffusion length is no longer independent of direction but is greater when measured along the dislocations than across them. The model used to explain the results suggests that the anisotropies observed will be more marked for crystals in which the dislocations are high polygonized. 12 ref.
(N3r, M26b; Ge, Si; 14-61)

152-N. Radial Variation of Minority Carrier Lifetime in Vacuum-Grown Germanium Single Crystals. C. A. Hogarth and P. J. Hoyland. *Journal of Electronics and Control,* v. 4, Jan. 1958, p. 60-62.

(N3r, P15, Ge, 14-61)

153-N. Rate of Growth of Diffusion Layers in U-Al and U-AlSi Couples. L. S. DeLuca and H. T. Sumsion. Knolls Atomic Power Laboratory. *U. S. Atomic Energy Commission,* KAPL-1747, May 1, 1957, 34 p.

12 ref. (N1c; U, Al, Si)

Physical Properties

114-P. Emissivities of Metallic Surfaces at 76° K. M. M. Fulk and M. M. Reynolds. *Journal of Applied Physics,* v. 28, Dec. 1957, p. 1464-1467.
(P17d)

115-P. Thermodynamics in Pyrometallurgy. J. W. Evans. *Research Applied in Industry,* v. 11, Jan. 1958, p. 12-18.

High-temperature thermodynamic studies; free energy data, experimental measurements and thermodynamics of liquid steel and slags. 27 ref. (P12, D11n; ST, RM-q)

116-P. Correlation of the Thermomagnetic and Domain Behaviour of a Single Crystal of Silicon-Iron. L. F. Bates, D. A. Christoffel, H. Clow and P. F. Davis. *Royal Society, Proceedings,* v. 243, Series A, Dec. 24, 1957, p. 160-171.

18 ref. (P16c, Fe, Si, 14-61)

117-P. Elastic Scattering of Protons by Carbon, Aluminium, Nickel, Copper, Zinc, Niobium, Silver and Gold. G. W. Greenlees, L. Gioietta Kuo and M. Petravic. *Royal Society, Proceedings,* v. 243, Dec. 24, 1957, p. 206-216.

17 ref. (P17e, M25, 2-60; Al, C, Cb, Ag, Cu, Ni, Zn)

118-P. Surface Activity of Various Uranium and Uranium Alloy Ingots. J. Redfearn and B. W. Mott. *United Kingdom Atomic Energy Authority, Research Group,* A.E.R.E. M/M 12, 1957, 4 p.

The increased surface beta-activity of uranium alloy ingots prepared in a vacuum furnace is related to segregation of the thorium isotope at the surface, probably due to preferential oxidation. Beta counts up to 25 times that of normal uranium have been obtained from the ingot surfaces. (P17d; Th, U, 5-59)

119-P. Superconducting Transitions in Tin Whiskers. *U. S. National Bureau of Standards, Technical News Bulletin,* v. 12, Jan. 1958, p. 6-8.

(P15g, 14-61; Sn)

120-P. (German.) **Hydrogen and Eddy Current Losses of Iron With Different Silicon Content.** Friedrich Erdmann-Jesnitzer and Karl Schreck. *Neue Hütte,* v. 2, Oct. 1957, p. 626-636.

Magnetic behavior; hydrogen and magnetization. 41 ref.
(P16s, 2-60; Fe, *Si, H*)

121-P. (German.) **Magnetic Measurements in the System Copper-Manganese.** Erich Scheil and Ernst Wachtel. *Zeitschrift für Metallkunde,* v. 48, Nov. 1957, p. 571-582.

Susceptibility maximum between 20 and 25 at. % Mn. Maximum increases by aging and decreases by plastic deformation. Ferromagnetic properties at diverse temperatures and structural states.
(P16; Cu, *Mn*)

122-P. (German.) **Conductivity and Hall-Constant. Pt. 3. Alpha-Copper-Zinc-Alloys.** Werner Köster and Wolfgang Schüle. *Zeitschrift für Metallkunde,* v. 48, Nov. 1957, p. 588-591.

(P15; Cu, *Zn*)

123-P. (German.) **Conductivity and Hall Constant. Pt. 4. Copper-Nickel-Alloys.** Werner Köster and Wolfgang Schüle. *Zeitschrift für Metallkunde,* v. 48, Nov. 1957, p. 592-594.

(P15; Cu, Ni)

124-P. (German.) **Contribution to Calculation of Viscosity of Molten Metals.** Anton Hrbek. *Zeitschrift für Metallkunde,* v. 48, Nov. 1957, p. 603-605.

Thermodynamic interpretation of dependence of internal friction on temperature. A linear dependence between the reduced activation energy and the superheating of melt above the melting point.
(P10f, P13a, Q22, 2-61; 14-60)

125-P. (Hungarian.) **Procedures Causing Dimensional Changes in Hardened Steel. Pt. 1.** Zoltan Csepiga. *Kohaszati Lapok,* v. 12, June 1957, p. 228-233.

Phase alterations while heat treating. (P10d, N8, J general; ST)

126-P. Electronic Paramagnetic Resonance in Natural Beryllium Crystals. M. M. Zaripov and Iu. Ia. Shamonin. *Academy of Sciences of the USSR, Bulletin,* no. 11, p. 1114-1115. (Translation by Columbia Technical Translations.)

(P16p; Be)

127-P.* Thermodynamic Study of Fe-Ca-P-O, Fe-Ca-Si-P-O, and Some Complex Molten Silicophosphate Systems. E. T. Turkdogan and Patricia M. Bills. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 143-153.

The ferric-ferrous iron reaction was studied by equilibrating pure Fe-Ca-P-O and Fe-Ca-Si-P-O molten systems with carbon-dioxide-carbon-monoxide mixtures of known compositions at 1550° C. In the iron-calcium phosphate system there is a large miscibility gap at P_{CO_2}/P_{CO} = 11.4, but at higher oxygen potentials the composition range of this miscibility gap decreases. 17 ref. (P12, D11n; Fe)

128-P. Atomic Age Challenge to Steel. Edward A. Livingstone. *Journal of Metals,* v. 10, Feb. 1958, p. 111-113.

Steel application in reactor systems with special reference to neutron absorption cross-section, induced radioactivity and corrosion in reactor cooling systems.
(P17, R4, W11p, 17-57, 2-67; ST)

129-P. (English.) **Magnetic Susceptibilities of Lanthanum and the Lanthanum-Hydrogen System.** B. Stalinski. *Academie Polonaise, Bulletin,* v. 5, no. 10, 1957, p. 997-1000.

12 ref. (P16; La)

130-P. (English.) **Measurements of the Galvanomagnetic Tensors of Bismuth.** Toshihiro Okada. *Physical Society of Japan, Journal,* v. 12, Nov. 1957, p. 1327-1337.

Anisotropy of galvanomagnetic effects in single crystals of pure Bi investigated between 160 and 45° C. Results were analyzed by the phenomenological theory of galvanomagnetic effects. 17 ref. (P16; Bi, 14-61)

131-P.* (French.) **Electrochemical Behavior of Boron. Potential-pH Diagram for the B-H_2O System at 25° C.** E. Deltombe, N. de Zoubov and M. Pourbaix. *Cebelcor, Rapport Technique no. 47,* Mar. 1957, 19 p.

Free enthalpy values, equilibrium reactions and formulas, stability of boron; formation and stability of boron hydrides; stability of boric acid and borates; constitution of boric solutions. 39 ref.
(P15, P12r, R10c; B)

132-P.* (French.) **Electrochemical Behavior of Bismuth. Potential-pH Diagram of the Bi-H_2O System at 25° C.** J. Van Muylder and M. Pourbaix. *Cebelcor, Rapport Technique no. 48,* May 1957, 13 p.

On basis of standard free enthalpy values of the system Bi-H_2O, an equilibrium diagram was established in function of pH and electrode potential at 25° C. Five solid substances, two dissolved and one gaseous were studied. Diagram provided general information on electro-chemical behavior of Bi, and conditions of stability and formation of Bi, its oxides and its ions. Operating conditions for use of Bi electrodes for measuring pH were also studied. (P15, P12r, R10c; Bi)

133-P.* (French.) **Electrochemical Behavior of Technetium. Potential-pH Diagram for the Tc-H_2O System at 25° C.** N. de Zoubov and M. Pourbaix. *Cebelcor, Rapport Technique no. 50,* May 1957, 12 p.

Free enthalpy values; equilibrium diagram covering three dissolved, five solid forms of technetium; stability conditions of Tc and its oxides; passivating effect of pertechnetates; theoretical possibility of use of technetium electrode to measure pH. 43 ref. (P15, P12r, R10c; Tc)

134-P.* (French.) **Electrochemical Behavior of Rhenium. Potential-pH Diagram for the Re-H_2O System at 25° C.** N. de Zoubov and M. Pourbaix. *Cebelcor, Rapport Technique no. 51,* May 1957, 14 p.

Free enthalpy values; equilibrium diagram for four dissolved, five solid forms of Re; conditions of stability and corrosion of Re and of stability of oxides of Re; passivating effect of perrhenates, which is compared to that of pertechnetates. 49 ref. (P15, P12r, R10c; Re)

135-P.* (French.) **Electrochemical Behavior of Tantalum. Potential-pH Diagram of the Ta-H_2O System at 25° C.** J. Van Muylder and M. Pourbaix. *Cebelcor, Rapport Technique no. 52,* May 1957, 10 p.

Diagram valid for solutions not containing substances capable of combining with Ta in soluble compounds was charted for metallic Ta and Ta_2O_5, and was used to study

stability of these substances. Theoretical conditions of immunity and passivation of Ta were deduced. Diagram illustrates basic noncorrodibility of this metal in noncombining aqueous solutions of any pH, due to formation of protective oxide film. 45 ref. (P15, R10c; Ta)

136-P.* (French.) **Electrochemical Behavior of Columbium. Potential-pH Diagram of the Cb-H_2O System at 25° C.** J. Van Muylder, N. de Zoubov and M. Pourbaix. *Cebelcor, Rapport Technique no. 53,* June 1957, 11 p.

Free enthalpy values, theoretical conditions of stability of Cb, CbO, CbO_2 and Cb_2O_5; conditions of immunity and passivation of the metal. Cb is noncorrodible in noncombining solutions of any pH, due to formation of protective oxide film. 45 ref. (P15, P12r, R10c; Cb)

137-P.* (French.) **Electrochemical Behavior of Antimony. Potential-pH Diagram of the Sb-H_2O System at 25° C.** A. L. Pitman, M. Pourbaix and N. de Zoubov. *Cebelcor, Rapport Technique no. 55,* Jan. 1957, 18 p.

Free enthalpy values; influence of pH on solubility of Sb_2O_3 and Sb_2O_5; theoretical conditions of corrosion, immunity and passivation of antimony. Diagram was used to study general conditions of corrosion and noncorrosion of the metal, and operating conditions of two types of Sb electrodes. 34 ref.
(P15, P12r, R10c; Sb)

138-P.* (French.) **On the Evolution of the Electrical Resistance of Zone-Melted Cold Worked Aluminum During Annealing at −79° C.** Omourtague Dimitrov and Philippe Albert. *Comptes Rendus,* v. 245, Dec. 16, 1957, p. 2275-2277.

A technique was developed for rolling of Al in liquid nitrogen. Specimens thus cold worked, others cold worked at room temperature and placed at once at temperature of liquid nitrogen, plus others cold worked at −18° C., were then annealed at −79° C. and evolution of electrical resistance was measured. Al cold worked in liquid nitrogen developed resistance faster and in greater magnitude than other specimens, and recrystallized completely after 200 hr. at −52° C.; same metal cold worked at −18° C. recrystallized completely only after 200 hr. at −38° C. (P15g, N5, 3-68; Al)

139-P.* (French.) **L and K Absorption Spectra of Some Copper Alloys.** Annie Lucasson-Lemasson. *Comptes Rendus,* v. 246, Jan. 6, 1958, p. 94-97.

Results of measurements of L_{III} spectrum of Ni-Cu, Zn-Cu and Al-Cu alloys; of K spectrum of Ni-Cu and Zn-Cu alloys. 8 ref. (P17c; Cu)

140-P. (German.) **Physical Properties of Hard Metals as Function of Carbon Content.** R. Bernard. *Neue Hütte,* v. 2, Dec. 1957, p. 757-761.

5 ref. (P-general, M26, 2-60; EG-d37)

141-P.* (Spanish.) **The Brailsford Method of Determining Hysteresis Losses in Silicon Steels.** Francisco Marcos Villanueva. *Revista de Ciencia Aplicada,* v. 11, Nov-Dec. 1957, p. 530-534.

Experimental critique of magnetometric method proposed by Brailsford and comparison of results with those obtained by ballistic procedure. Variations of characteristic constants of Si steel when subjected to various types of mechanical and heat treatments.

(P16a, 1-54; AY, *Si,* SGA-n)

142-P.* Experimental Investigation of Thermionic and Secondary-Electron Emission From Copper and Germanium in Transition From the Solid to the Liquid State. V. G. Bol'shov. *Academy of Sciences of the USSR, Bulletin, Physical Series,* v. 20, no. 10, p. 1020-1026. (Columbia Technical Translations.)

Investigation to determine work functions of different faces of Cu and Ge crystals at the melting point. Values obtained differ greatly from those of other researchers; divergence is credited to high purity and cleanliness of materials studied and of equipment used in experiments. 8 ref. (P15k, N12; Cu, Ge)

143-P.* Lattice Thermal Conductivity of Some Copper Alloys. W. R. G. Kemp, P. G. Klemens and R. J. Tainsh. *Australian Journal of Physics,* v. 10, Dec. 1957, p. 454-461.

Thermal and electrical conductivities of three Cu-Zn alloys annealed at high temperatures and of two Cu-Au alloys, were measured over wide range of low temperatures and their lattice component of thermal conductivity deduced in the range 2-90° K. The high lattice thermal resistance at liquid helium temperatures previously found in Cu-Zn alloys appears to be a function of solute content rather than of concentration of conduction electrons, and can be reduced by high-temperature annealing. This extra resistance is thus due to dislocations locked in stable arrays by the presence of solute atoms, and not due to changes in the electronic band structure on alloying. 10 ref.
(P11h, P16g; Cu, *Au, Zn*)

144-P. Quantitative Theory of the Electro-Formation of Metal-Germanium Point Contacts. A. C. Sim. *Journal of Electronics and Control,* v. 3, Aug. 1957, p. 139-159.

15 ref. (P15p; Ge)

145-P.* Effect of Heat Treatment on the Bulk Lifetime of Excess Charge Carriers in Silicon. L. M. Nijland and L. J. van der Pauw. *Journal of Electronics and Control,* v. 3, Oct. 1957, p. 391-395.

Effects of heat treatment in the range between room temperature and 1250° C. Bulk lifetime both in p and n-type crystals made by the floating zone method and of n-type crystals made by the Czochralski technique may be increased by annealing at temperatures between about 300 and 700° C. Annealing at temperatures higher than about 700° C. decreased lifetime both in p and n-type crystals. In all cases the samples were relatively slowly cooled. Bulk lifetime was measured by the conductivity modulation method. (P15, 2-64; Si)

146-P. Transverse Magnetoresistance Effect in Indium Arsenide. C. H. Champness and R. P. Chasmer. *Journal of Electronics and Control,* v. 3, Nov. 1957, p. 494-499.

6 ref. (P16; As, In)

147-P. Superconductivity of Lanthanum and Some Alloys. G. S. Anderson, S. Legvold and F. H. Spedding. *Physical Review,* v. 109, Jan. 15, 1958, p. 243-247.

(P15g; La)

148-P. X-Ray Study of Deuteron-Irradiated Copper Near 10° K. R. O. Simmons and R. W. Balluffi. *Physical Review,* v. 109, Jan. 15, 1958, p. 335-344.

61 ref. (P18, 2-67; Cu)

149-P. Solid Solutions Between Ferromagnetic and Antiferromagnetic Compounds With NiAs Structure. *Physics and Chemistry of Solids,* v. 3, no. 3/4, 1957, p. 238-249.

13 ref. (P16, 14-67; Ni, As)

150-P. Low Temperature Electrical and Magnetic Behavior of Dilute Alloys of Mn, In, Cu. R. W. Schmitt and I. S. Jacobs. *Physics and Chemistry of Solids,* v. 3, no. 3/4, 1957, p. 324-337.

30 ref. (P15g, P16, 2-63; Mn, Cu, In)

151-P.* Energy Loss in Transformer Steel. G. M. Leak. *Research Applied in Industry,* v. 11, Feb. 1958, p. 56-60.

Effects of carbon and nitrogen on high-purity alloys; nitrogen has greater influence. Most effective way to remove nitrogen or reduce its influence is by altering the shape and size of precipitated nitride. 11 ref. (P15, 2-60, N7; ST, SGA-n)

152-P.* Heats of Adsorption on Evaporated Nickel Films. D. F. Klemperer and F. S. Stone. *Royal Society, Proceedings,* v. 243, Jan. 14, 1958, p. 375-399.

The adsorption of oxygen, hydrogen and carbon monoxide has been studied on evaporated films of Ni prepared under varied conditions with a view to defining more precisely the differences in behavior between Ni films and Ni powder. Heats of adsorption on the films have been determined at room temperature using a resistance-thermometer calorimeter. Extent of the adsorption with oxygen and hydrogen has been assessed by means of krypton isotherms at 77° K., and by means of established correlations between activity and weight for equivalent films. 28 ref.
(P12q, P13d; Ni, 14-62)

153-P. Formation of Porosity in Uranium Under the Action of Thermal Cycling. A. A. Bochvar and G. I. Tomson. *Soviet Journal of Atomic Energy,* v. 2, no. 6, 1957, p. 637-643. (Translated by Consultants Bureau, Inc.)

(P10m, Q25p; U)

154-P.* Effects of Thermal Upsetting in 5052 Aluminum Alloy. R. E. Holt, E. C. Roberts and J. W. Anderson. *Trend in Engineering,* v. 10, Jan. 1958, p. 18-21.

Changes in structure, as well as plastic and elastic behavior of a structural alloy confined axially during heating to various elevated temperatures. 8 ref.
(P10d, 2-62; Q21, Q23; Al)

155-P. (English.) **Variation of the Hall Coefficient of Mg-Cd Superlattice Alloys With Degree of Order.** Kiyoshi Yonemitsu and Takao Sato. *Physical Society of Japan, Journal,* v. 13, Jan. 1958, p. 15-22.

7 ref. (P15p, N10, 2-61; Cd, Mg)

156-P. (English.) **Determination of Cold-Work Energy in Copper by Means of Electrochemical Potential Measurements.** Asher Peres. *Research Council of Israel, Bulletin,* v. 6C, Nov. 1957, p. 9-12.

5 ref. (P12; Cu)

157-P. (English.) **Sorption of Hydrogen by Nickel Wire.** Akiya Matsuda. *Research Institute for Catalysis, Journal,* v. 5, Nov. 1957, p. 71-86.

8 ref. (P13d; Ni, *H,* 4-61)

158-P. (German.) **Conductivity and Hall Constant. Pt. 7. Deformation and Recrystallization of Pure Metals.** W. Köster and W. Schüle. *Zeitschrift*

(*)Articles Available Through Photocopy Service; See Coupon, p. 6

für Metallkunde, v. 48, Dec. 1957, p. 634-636.

(P15g, Q24, N5; Cu, Ag, Au, Pd, Pt, Mo, W, Al)

Mechanical Properties and Tests

274-Q. How Ceramics Help Metals Beat Heat Barrier. William Beller. *American Aviation*, v. 21, Dec. 16, 1957, p. 43-44.

Ceramic coatings increase heat resistance. (Q general, 2-62; 8-71)

275-Q. Stresses After Hardness. S. K. Setty, J. T. Lapsley and E. G. Thomsen. *ASME Paper No. 57-A-77*, Dec. 1957, 3 p.

Results of hardness tests on metal specimens subjected to uniform and gradient stresses. Materials became softer under tension, harden under compression. 5 ref. (Q29, 3-66)

276-Q. Program for the Appraisal of the Tendency of Brittle Fracture in Steel Forgings. A. O. Schaefer. *ASME Paper No. 57-A-262*, Dec. 1957, 6 p.

(Q26s, 5-51; ST)

277-Q. Creep Design Workshop. *ASME Paper No. 57-A-286*, Dec. 1957, 12 p.

Creep-rupture data, creep design and service life. (Q3, 17-51)

278-Q. Mechanical and Physical Characteristics of Jewelry Bronze, 87-5% Strip. Delmar E. Trout. *ASTM Bulletin*, no. 227, Jan. 1958, p. 45-50.

(Q general, P general, T9s; Cu-s, 4-53)

279-Q. Effect of Loading Rate on Adhesive Strength. Frank Moser and Sandra S. Knoell. *ASTM Bulletin*, no. 227, Jan. 1958, p. 60-63.

Results show significant differences between loading rates, testing machines and adhesives. (Q10c, 3-67, 1-54; NM-d34)

280-Q. A Recording Torsion Testing Machine for Wire. H. C. Burnett. *ASTM Bulletin*, no. 227, Jan. 1958, p. 68-69.

(Q1, 2-53; 5-61)

281-Q.* Impact Fatigue Resistance of Structural Steels. B. N. Das and G. D. Sani. *Indian Institute of Metals, Transactions*, v. 10, 1956-57, p. 103-118.

Studies made by using transverse impact stressing on rotating unnotched test pieces. Curves showing the kinetic energy versus number of impacts exhibit the characteristic of S-N curves, indicating a limiting value of K. E., that is, a definite endurance limit under impact. Criterion for failure under repeated transverse impact was determined by an electrical resistance gage and measuring units. 16 ref. (Q7a, Q6p; ST, SGB-s)

282-Q.* Inhomogeneous Deformation in Polycrystalline Metals. R. C. Deshpande. *Indian Institute of Metals, Transactions*, v. 10, 1956-57, p. 131-137.

Test specimens of commercial Al containing only few grains were deformed in tension and microhardness determinations made within grains and near grain boundaries. Local deformations measured; elongations of different portions of each grain determined; elongation varies in different grains and deformation not uniform; tendency to conform in elongation at grain boundaries, and nearly minimum near junction of three grains. 9 ref. (Q24, M27c)

283-Q. Investigation of the Compressive Strength and Creep Lifetime of 2024-T3 Aluminum-Alloy Plates at Elevated Temperatures. Eldon E. Mathauser and William D. Deveikis. *National Advisory Committee for Aeronautics*, Report 308, 1957, 14 p.

8 ref. (Q3, Q28; Al, 4-53)

284-Q. Elastic Deformation and the Laws of Friction. J. F. Archard. *Royal Society, Proceedings*, v. 243, Dec. 24, 1957, p. 190-205.

An examination as to whether the hypothesis of elastic deformation of surface protuberances is consistent with Amonton's law (that the friction is proportional to the applied load). Experiments show that the friction is porportional to the true area of contact; whether or not Amonton's law is obeyed depends upon the surface topography. 19 ref. (Q9q, Q21)

285-Q. Brittleness of Ferro-Chrome-Aluminium Resistance Alloys. *Wire Production*, v. 6, Oct. 1957, p. 14-15.

(Q26s; Fe, Cr, Al, SGA-q)

286-Q. (German.) **Testing of Heat Resistant Powder Metal Materials.** F. Eisenkolb and W. Schatt. *Die Technik*, v. 12, Dec. 1957, p. 824-828.

Cermets consisting of clay with 10 to 90% Cr chromium tested for specific gravity, bending break strength, tensile strength, hardness, bending strength under impact, electric resistance and texture. 7 ref. (Q general, P general; SGA-h, 6-70)

287-Q. (German.) **Properties of Metal Melts. Pt. 13. The Internal Friction of Bismuth.** Erich Gebhardt and Konrad Köstlin. *Zeitschrift für Metallkunde*, v. 48, Nov. 1957, p. 601-602.

Measurements of internal friction at temperatures up to 600°. No influence of short range ordering on internal friction. (Q22, N10, 2-61; Bi)

288-Q. Method for Studying the Behavior of Cutting Fluids in Wear of Tool Materials. L. V. Colwell. *American Society of Mechanical Engineers*, Paper no. 57-A—160, May 1957, 5 p.

4 ref. (Q9p; SGA-j, NM-h)

289-Q. Croloy 15-15N. Austenitic Heat-Resistant Alloy for Severe Tubular Applications at Elevated Temperatures. J. F. Ewing. *American Society of Mechanical Engineers*, Paper no. 57-A—205, Dec. 1957, 10 p.

(Q-general, 17-57; SS, SGA-h, 4-60)

290-Q. Prediction of Creep in Bending From Tension and Compression Creep Data When Creep Coefficients Are Unequal. W. N. Findley, J. J. Poczatek and P. N. Mathur. *American Society of Mechanical Engineers*, Paper no. 57-A—213, Dec. 1957, 20 p.

14 ref. (Q3)

291-Q. Micro-Hardness Testing. R. Wall. *Atomics and Nuclear Energy*, v. 9, Jan. 1958, p. 22-23.

(Q29q)

292-Q. Creep Tests on Materials for Gas-Cooled Reactors. *Atomics and Nuclear Energy*, v. 9, Jan. 1958, p. 26.

New equipment designed to provide creep and stress-rupture data on metals and alloys in gaseous atmospheres or high temperatures and pressures. (Q3, 1-53, T11, 17-57)

293-Q. Effect of Heat Treatment on Low Temperature Internal Friction Maxima. T. S. Hutchison and G. J. Hutton. *Canadian Journal of Physics*, v. 36, Jan. 1958, p. 82-87.

9 ref. (Q22, 2-64; Al)

294-Q.* Metallography of Low-Carbon Bainitic Steels. K. J. Irvine and F. B. Pickering. *Iron and Steel Institute, Journal*, v. 188, Feb. 1958, p. 101-112.

A relationship has been obtained between tensile strength or transformation temperature and the structural features. At high transformation temperatures (the lower tensile-strength level), the strength is largely controlled by grain size and, as the transformation temperature decreases, the grain size decreases and the tensile strength increases. At low transformation temperatures (the high tensile-strength level), although grain size is very fine, there is an increasing strengthening effect due to the dispersion hardening effect of the carbide particles. 13 ref. (Q27a, 2-59, N8m; CN-g)

295-Q. Recent Advances in Cermets. Robert Steinitz. *Jet Propulsion*, v. 28, Jan. 1958, p. 15, 68-70.

Why cermets behave as they do; impact resistance and ductility. 18 ref. (Q-general, M27; 6-70)

296-Q. On Rigid Work-Hardening Solids With Singular Yield Conditions. W. E. Boyce and W. Prager. *Journal of Mechanics and Physics of Solids*, v. 6, no. 1, 1957, p. 1-12.

Uniqueness theorems and extremum principles in light of increased use of singular yield conditions in recent work on plastic disks, plates and shells. 4 ref. (Q23a)

297-Q. Fatigue Crack Propagation in Torsion. J. A. H. Hult. *Journal of Mechanics and Physics of Solids*, v. 6. no. 1, 1957, p. 47-52.

5 ref. (Q7h, 9-72)

298-Q. Effect of Impact Loading on the Static Yield Strength of a Medium-Carbon Steel. J. D. Campbell and C. J. Maiden. *Journal of Mechanics and Physics of Solids*, v. 6, no. 1, 1957, p. 53-62.

8 ref. (Q6, Q23b; CN-p)

299-Q. Associated Flow Rule of Plasticity. D. R. Bland. *Journal of Mechanics and Physics of Solids*, v. 6, no. 1, 1957, p. 71-78.

The flow rule at singular points on a yield surface is found by considering the actual yield surface as the limit of a sequence of regular surfaces. Confirms the work-hardening and linearity hypothesis of Drucker. 10 ref. (Q23a, Q24)

300-Q. Elastic-Plastic Torsion of Sharply Notched Bars. J. A. H. Hult. *Journal of Mechanics and Physics of Solids*, v. 6, no. 1, 1957, p. 79-82.

The shape of the incipient plastic region at the tip of a sharp notch in a twisted bar is derived, assuming the material to be ideally plastic. The result is used to determine the strain in the plastic region. 5 ref. (Q1d)

301-Q.* New Alumina-Type Cermets. Thomas F. Frangos. *Materials in Design Engineering*, v. 47, Feb. 1958, p. 112-115.

Three types of cermets having alumina as the ceramic phase have been developed: chromium-alumina (LT-1); molybdenum-chromium-alumina (LT-1b); tungsten-chromium-alumina (LT-2). High-temperature strength, erosion and wear resistance, oxidation resistance, resistance to molten metals. (Q-general, 1-62, R6m; 6-70)

302-Q.* Vacuum Cast Nickel Alloy Versus 'Best' Cobalt Alloy. J. J. Eisenhauer and John Preston. *Materials in Design Engineering*, v. 47, Feb. 1958, p. 116-117.

At 1200° F., the vacuum cast Ni-base alloy, Udimet 500, has three times the tensile strength of arc-cast AMS 5382, generally considered the best available Co-base high-temperature alloy. Under the same conditions of stress and service life, the operating temperature can be raised from 1525 to 1700° F. by substituting the Ni alloy, now commercially available, for the Co alloy.
(Q27a, 2-62, E-general, 1-73; SGA-h, Ni, Co)

303-Q.* **Stronger Aluminum Casting Alloys.** F. H. Smith. *Metallurgia,* v. 47, Feb. 1958, p. 64-70.

Demand for two types of strong Al casting alloy; in one, proof stress is regarded as more important than ductility and, in the other, the reverse. Alloys of Al with Cu, Mg, Zn and Mg, Si and Mg. It should be possible, by reducing the iron content of alloy LM 8 to about 0.15%, and by appropriate selection of Mg content and heat treatment, to produce stronger or, alternatively, tougher castings. 18 ref.
(Q27a, Q23p, 2-60, 2-64; Al, 5-60)

304-Q. **Effect of Environments of Sodium Hydroxide, Air, and Argon on the Stress-Rupture Properties of Nickel at 1500° F.** Howard T. McHenry and H. B. Probst. *National Advisory Committee for Aeronautics, Technical Note 3987,* Jan. 1958, 23 p.

13 ref. (Q3m, 2-62, 2-66; Ni)

305-Q. **Strength of Welds in Carbon Steel.** *Petroleum,* v. 21, Feb. 1958, p. 55-58.

51 ref. (Q27a, Q3m; CN, 7-51)

306-Q. (Hungarian.) **Impact Resistance of Steel Castings.** Zoltan Nagy. *Kohaszati Lapok,* v. 12, July 1957, p. 149-157.

(Q6; ST, 5-60)

307-Q. (Hungarian.) **Notes on Wear of Machine Tool Castings.** Miklos Cseh and Andor Gaal. *Kohaszati Lapok,* v. 12, July 1957, p. 163-171.

Service tests. 13 ref.
(Q9, W25, 17-57)

308-Q. (Swedish.) **Scatter in Strength of Light Alloy Castings.** F. Turner. *Gjuteriet,* v. 47, Dec. 1957, p. 204-206, 207-210.

Analysis of routine test results indicates different alloys should have different safety factors. 6 ref.
(Q-general, S12; T24; Mg, Al)

309-Q.* **Effect of Different Surface Treatments on the Fatigue Strength of Drill Steel.** T. W. Wlodek. *Canadian Mining and Metallurgical Bulletin,* v. 51, Feb. 1958, p. 89-101.

Effects of shot peening, induction surface hardening, spiral rolling, singly and in combination, on fatigue strength of SAE 1080 and Ni-Cr-Mo steels. Spiral rolling results in greatest improvement. Expected range and distribution of stresses during actual operations are estimated and mechanism of failure is analyzed. 26 ref. (Q7, 3-70, G23s; CN, AY, TS)

310-Q. **How to Measure the Effects of Slack-Quenching.** *Iron Age,* v. 181, Jan. 23, 1958, p. 80-82.

Impact test of steels shows uniformity of hardness and microstructure in any plane above immersion level and parallel to quenched end.
(Q6, J26n, ST)

311-Q.* **Fracture of Metals.** W. D. Biggs. *Iron and Steel,* v. 31, Feb. 1958, p. 57-60.

Review of the current theoretical explanations of crack initiation and propagation. Relationship between fracture stress, yield stress and grain size; influence of oxygen and yield delay on fracture stress. 42 ref.
(Q26)

312-Q.* **Internal Friction.** P. M. Robinson and R. Rawlings. *Iron and Steel,* v. 31, Feb. 1958, p. 65-68.

Using the linear relationships between the percent nitrogen and percent carbon in solid solution and the internal friction peak, the solubility of carbon and nitrogen in alpha iron at various temperatures is determined. The height of the internal friction peak is determined only by the quantity of solute in solid solution and is independent of the condition or size of the precipitate particles. Summary of work done using the internal friction measurement process. 60 ref. (Q22, N12p)

313-Q.* (French.) **Influence of Heat Treatment in Hydrogen Atmosphere on Properties of Binary Alloys of Magnesium and Zirconium.** Jean Herenguel, Jacques Boghen and Pierre Lelong. *Comptes Rendus,* v. 245, Dec. 16, 1957, p. 2272-2275.

Wrought alloy specimens containing from 0.20 to 0.57% Zr were treated in hydrogen atmosphere between 400 and 500° C.; reference specimens were treated in carbon dioxide and argon atmospheres; exposure times ranged up to 1000 hr. Mechanical properties were then measured at ordinary and high temperatures (200-500° C.) and endurance under given stress, contraction of cross section and distributed elongation after rupture were recorded. Structures were studied by micrography and tests made to determine respective percentages of soluble and insoluble zirconium.
(Q-general, J2k; Mg, *Zr*)

314-Q.* (French.) **New Research on Refractory Vanadium Steels.** A. Roos. *Metallurgie et la Construction Mécanique,* v. 90, Jan. 1958, p. 11-13.

Study undertaken to verify hypothesis that part of Mo content of refractory steels can be replaced by V, and to improve mechanical strength of these steels at high temperature. Vanadium tends to increase strength and to retard appearance of third (fastest) phase of creep. Equal refractoriness can be obtained by compositions containing less Mo and more V, provided proper normalizing heat treatment is given.
(Q27a, Q3, 2-62, 2-60; AY, *V*, SGB-q)

315-Q.* (German.) **Use, Manufacture and Heat Treatment of Cast Alloy Steel Rolls. Pt. 1. Stresses Heat Treating and Their Calculation.** Heinz Uhlitzsch and Gerhard Radomski. *Neue Hütte,* v. 2, Nov. 1957, p. 655-664.

Calculation of surface and core temperature and their temperature difference; compensating temperature and temperature difference across the section. 6 ref.
(Q25m, J-general, W23k; ST, 5-60)

316-Q. (Hungarian.) **Effect of Titanium on the Properties of Carburizing Steels.** Nandor Hajto. *Kohaszati Lapok,* v. 12, Jan-Feb. 1957, p. 3-14.

New types of Mg steel alloyed with Ti. 8 ref.
(Q-general, J28g; AY, *Mn, Ti*)

317-Q. (Italian.) **High-Temperature Alloys.** *Nickel,* no. 71, Dec. 1957, p. 1-12.

Properties to be considered in choice of heat resistant materials; metallic materials for high-temperature service and their properties. Covers cast iron, some wrought stainless steels, heat resisting casting alloys and superalloys.
(Q-general, 2-62; SGA-h, CI, SS)

318-Q.* **High-Temperature Strength of Alloys of Some Binary, Ternary, Quaternary, and Quinary Nickel Systems at 800°.** I. I. Kornilov and L. I. Pryakhina. *Academy of Sciences of the USSR, Proceedings, Chemistry Section,* v. 112, Jan-Feb. 1957, p. 5-7. (Translated by Consultants Bureau, Inc.)

Chromium, tungsten, titanium and aluminum were found to strengthen nickel by forming limited solid solutions of considerable concentration. Maximum strengthening is attained in regions of completely saturated and supersaturated solid solutions. 6 ref. (Q-general, N12p, 2-60, 2-62; Ni, *Al, Cr, Ti, W*)

319-Q.* **Fatigue Failures.** V. C. Young. *Eaton Engineering Forum,* v. 18, Dec. 1957, p. 2-8.

Basic causes of fatigue failure in internal combustion engine valves. Failures in neck or blend area are usually result of overstressing; lock groove areas fail because of high value seating velocities; head area failures are due to excessive operating temperature, excessive temperature gradients, overstressing from gas loading or mechanical high seating velocities combined with temperature. Methods for combatting each type of failure. (Q7, T7b)

320-Q. **Impact and Fatigue Properties of Ductile Cast Iron.** Charles F. Walton. *Machine Design,* v. 30, Jan. 1958, p. 128-131.

Influence of structure, composition, heat treatment on impact properties; fatigue strength, notch sensitivity, effects of surface finish on endurance limit. 6 ref.
(Q6n, Q7a; CI-r)

321-Q.* (German.) **Development of Macrohardness Recorder.** R. Böklen. *Werkstattstechnik und Maschinenbau,* v. 47, Nov. 1957, p. 627-630.

Experiments with a hardness recorder which marks force depth curve. Real hardness course can be most correctly determined with a penetrating body as sharp as possible. Force depth curve gives very precise permanent and objective results. (Q29, 1-53)

322-Q.* (Japanese.) **Properties of Cast Iron.** Kisao Abe. *Casting Institute of Japan, Journal,* v. 29, Dec. 1957, p. 846-853.

High-grade cast iron made with large amounts of steel scrap and with proper inoculation is superior to steel in compressive strength and acid resistance. It may be equal to steel in tensile strength, shock, fatigue and rust resistance. Tendencies toward increasing nitrogen and decreasing oxygen increase with higher percentage of steel scrap.
(Q-general; CI, RM-p)

Corrosion

177-R. **Oxidation of Carbon Steels.** S. S. Pani, K. C. Som and G. P. Chatterjee. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 195-199.

Rate of oxidation at different temperatures on vacuum diffusion of Ni and Cr.
(R1h, L15, 1-73; CN-b, *Ni, Cr*)

178-R. **Effects of Irradiation on Corrosion Resistance of Some High Uranium Alloys.** Sherman Greenberg and Joseph E. Draley. *Nuclear*

(*)Articles Available Through Photocopy Service; See Coupon, p. 63

Science and Engineering, v. 3, Jan. 1958, p. 19-28.

Report of corrosion tests on U-base alloys in high-temperature water. 6 ref. (R4a, 2-67; U)

179-R. (German.) **Corrosion and Corrosion Protection.** Wilhelm Wiederholt. *Erdöl und Kohle,* v. 10, Nov. 1957, p. 773-777.

The most important manifestations, causes and process of corrosion; methods of protection. 5 ref. (R general)

180-R. (German.) **Corrosion Prevention in Turkey Using Colarit-Flame-Spraying of Coal Tar Pitch.** Harald Stern. *Werkstoffe und Korrosion,* v. 8, Dec. 1957, p. 736-738.

(R10f, L26a)

181-R. (German.) **Inhibitive Action of Sodium Benzoate on Atmospheric Corrosion of Mild Steel.** O. Sarc-Lahodny. *Werkstoffe und Korrosion,* v. 8, Dec. 1957, p. 738-742.

6 ref. (R3, R10b; CN)

182-R. (German.) **Modern Detergents and Hot Galvanization.** Heinz Bablik and M. Belohlavy. *Werkstoffe und Korrosion,* v. 8, Dec. 1957, p. 742-746.

Detergents containing polyphosphates attack hot galvanized surfaces. (R6j, *Zn,* 8-65)

183-R. (German.) **Corrosion Testing of Chemically Resistant Steels in Liquids.** Herbert Zitter. *Werkstoffe und Korrosion,* v. 8, Dec. 1957, p. 746-760.

Series of experiments show how different factors influence results of tests on Cr-Ni steel in inorganic acids. 22 ref. (R11, R6g; *Cr, Ni,* SS)

184-R. Erosion and Corrosion of Turbine Materials in Wet Oxygenated Steam. H. A. Cataldi, C. F. Cheng and V. S. Musick. *American Society of Mechanical Engineers,* Paper no. 57-A—134, Aug. 1957, 12 p.

Laboratory tests evaluating resistance of various materials for turbines and related components to erosion (impact, washing, wiredrawing) and corrosion (weight loss, pitting depths, crevice and galvanic attack). 12 ref. (R1c, R4d, R11, W11k)

185-R. Ferrous Hydroxide Solubility, Thermal Decomposition and Role in the Corrosion of Iron. P. D. Miller, J. J. Ward, O. M. Stewart and R. S. Peoples. *American Society of Mechanical Engineers,* Paper no. 57-A—184, Dec. 1957, 13 p.

Decomposition of pure ferrous hydroxide between 250 and 550° F. The major decomposition products are hydrogen and magnetite; minor constituents are alpha iron and Fe_2O_3. The rate of decomposition is such that it is concluded that the decomposition of ferrous hydroxide is not the rate-controlling step in the iron-water corrosion reaction at temperatures above 250° F. 6 ref. (R4d; Fe)

186-R. Sulfuric-Acid Corrosion in Oil-Fired Boilers and Studies on Sulfur-Trioxide Formation. Donald R. Anderson and Frank P. Manik. *American Society of Mechanical Engineers,* Paper no. 57-A—199, Dec. 1957, 12 p.

Sulphuric-acid corrosion in air heaters and economizers of residual oil-fired boilers. Factors controlling oxidation of sulphur dioxide to sulphur trioxide during combustion process of residual fuels. 35 ref. (R6g, R7k; ST)

187-R. Mass Transfer. A. K. Covington. *Atomics and Nuclear Energy,* v. 9, Jan. 1958, p. 10-11, 34.

9 ref. (R2a, T11)

188-R. Corrosion of Iron and Steel in the Salt-Crust Treatment of Mine Roads and Its Suppression by Inhibiting Agents. A. L. Godbert and M. C. White. *British Safety in Mines, Research,* Report 143, Oct. 1957, 24 p.

The salt-crust process as means of preventing coal-dust explosions by immobilizing coal dust deposited on mine roads. (R6, R10b; Fe, ST)

189-R. Study of the Corrosion of Vaporizing-Liquid Type Fire Extinguishers. J. A. Bono. *Underwriters' Laboratories, Inc., Bulletin of Research,* no. 50, Dec. 1957, 54 p.

Principal factor in corrosion of pump-type vaporizing-liquid fire extinguishers was found to be the composition of the liquid. Presence of 0.80% carbon disulphide, and use of trichloroethylene as freezing point depressant found to be desirable characteristic of the liquid. Absence of carbon disulphide rendered extinguishers very susceptible to corrosion. (R6p)

190-R. Corrosion of Aluminum by Alkaline Sequestering Solutions. H. W. McCune. *Industrial and Engineering Chemistry,* v. 50, Jan. 10, 1958, p. 67-70.

Corrosion by alkaline and alkaline sequestering solutions, and by solutions of sodium triphosphate and tetra-acetate. 18 ref. (R6j; Al)

191-R.* Acceleration Corrosion Testing of Chromium-Plated Articles—Sulphur Dioxide Test. J. Edwards. *Institute of Metal Finishing, Bulletin,* v. 7, Winter 1957-1958, p. 55-78.

Accelerated corrosion test employing a humid atmosphere containing sulphur dioxide. Permissible variations in sulphur dioxide concentration, relative humidity and temperature; required conditions can be maintained by simple methods; 24 hr. is a sufficiently long test period for most purposes. The corrosion pattern developed closely resembles that produced by outdoor exposure. The test is suitable for a variety of coatings on steel, and may also be effective on other basis metals. 7 ref. (R11k; ST, 8-62, *Cr*)

192-R.* Potentiostat Technique for Studying the Acid Resistance of Alloy Steels. C. Edeleanu. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 122-132.

It is possible to determine a "potential-current" (P-C) diagram for each steel and from these it is possible to predict under what conditions the steel will have adequate resistance. The potential-corrosion-rate curve can be regarded as an anodic polarization curve by substituting the equivalent current for the corrosion rate, and from it, it is possible to determine the rate at which the anodic (electron-producing) reaction tends to occur at any given potential. 14 ref. (R11a, R6g; AY)

193-R. Corrosion Resistance of Nickel Alloys in Molten Sodium Hydroxide. H. B. Probst, C. E. May and Howard T. McHenry. *National Advisory Committee for Aeronautics,* Technical Note 4157, Jan. 1958, 26 p.

12 ref. (R6j; Ni)

194-R. Ultrasonics in the Oil Industry. Corrosion Damage Detection. F. M. Savage. *Petroleum,* v. 21, Feb. 1958, p. 53-54.

(R2, S14g)

195-R. Copper Ion Displacement Test for Screening Corrosion Inhibitors. William B. Hughes. *Petroleum Technology, Journal,* v. 10, Jan. 1958, p. 54-56.

(R10b)

196-R. Effect of Wire Metal on the Thermal Life of Enameled Magnet Wire. J. H. Thomas and J. F. Dexter. *Power Apparatus and Systems,* no. 33, Dec. 1957, p. 1009-1013.

(R2, T1, 5-61; Cu, 4-61)

197-R. (English.) **Corrosion Control.** Herbert H. Uhlig. *Teknisk-Vetenskaplig,* v. 28, no. 8, 1957, p. 351-354.

8 ref. (R1)

198-R. (Dutch.) **Corrosion and Corrosion Research.** P. J. Gellings. *Lastechniek,* v. 24, Jan. 1958, p. 1-5.

Examples of corrosion including some due to welding. 5 ref. (R1, R2; 7-51)

199-R. (Hungarian.) **Reasons for Blisters on Aluminum Plates.** Tibor Laar. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 185-193.

10 ref. (R2n, 9-71; Al, 4-53)

200-R. (Hungarian.) **Oxidation of Porous Sintered Steel Parts.** Pal Csokan. *Kohaszati Lapok,* v. 12, July 1957, p. 317-319.

Reduction of corrosion by oil impregnation. (R1h, R10f; 6-71, ST)

201-R. (Russian.) **Brass Corrosion in Alkaline Solution.** L. S. Zhuravlev and D. Ya. Kagan. *Electricheskie Tantsu,* v. 28, Dec. 1957, p. 26-28.

Experiments show that presence of oxygen intensifies corrosion of brass in alkaline solution; elimination of oxygen reduces corrosion to negligible factor. (R6j; Cu-n)

202-R.* Corrosion Resistance of Tin Alloy Electrodeposits. Frederick A. Lowenheim. *44th Annual Technical Proceedings, American Electroplaters' Society,* 1957, p. 42-46.

Advantages and limitations of using Sn and Sn alloys for corrosion prevention. Compositions and results of exposure tests on Sn-Zn, Sn-Cd, Sn-Pb, Sn-Ni and Sn-Cu alloys. Tin is good undercoat for Zn and Cd in marine environment and can be used for undercoat of both organic and metallic coatings. Although Sn-Zn alloy is not choice coating for protection of steel, it appears promising in contact with Al. Superiority of bronze over Cu as undercoat in Ni-Cr systems is shown. 35 ref. (R3n, R3p, L17b, 2-60; *Sn*)

203-R. Materials for Corrosion Control. Frederick W. Fink. *Industrial and Engineering Chemistry,* v. 50, Jan. 10, 1958, p. 67-70.

Review of literature; new corrosion problems in nuclear energy field; potentials and limitations of Ti and Zr in corrosion control. 18 ref. (R-general, T11, 17-57; Ti, Zr)

204-R.* (French.) **Prevention of Corrosion and Scale Formation by Magnetic Treatment of Liquids.** Theo Vermeiren. *Cebelcor, Rapport Technique no. 54,* Sept. 1957, 16 p.

Design of permanent magnet devices used in this technique; causes of failure of such devices; chemical effects of magnetic treatment and control of efficacy; applications. (R10a, 1-53, X11g)

205-R.* (French.) **Study of Physical Antiscaling Treatments.** J. Laureys and M. Pourbaix. *Cebelcor, Rapport Technique no. 56,* Sept. 1957, 36 p.

Laboratory installation for evaluation of efficacy of water treatment methods in the case of distilling equipment. Effectiveness of magnetic and electromagnetic treatments, mercury floats, and inocu-

lation with sodium metaphosphate and sodium uranate. Influence of a prior trickling treatment on scale-forming effect of nontreated water and magnetically treated water. Physicochemical effects connected with conditions of efficacy of physical treatments. Effect of external factors on crystallization phenomena. Current research program of Cebelcor Commission on Antiscale Formation Processes. 9 ref. (R10a, R4, A9)

206-R.* (French.) **Lessons on Electrochemical Corrosion (Provisional Notes). Pt. 1.** M. Pourbaix. *Cebelcor, Rapport Technique no. 57,* Nov. 1957, 26 p.

Part of course (in three parts) given at School of Applied Sciences of University of Brussels. Basic principles governing phenomena of corrosion by aqueous solutions and application of principles to study of technical problems of corrosion and scaling. Economic and technical aspects of corrosion; scientific aspects such as complexity of phenomena, use of chemical and electrochemical thermodynamics. 6 ref. (R1, R6)

207-R.* (French.) **On Grading the Corrosion Resistance of Steels Under Stress in Saline Solutions Saturated With Hydrogen Sulphide.** Eugene Herzog. *Comptes Rendus,* v. 245, Dec. 16, 1957, p. 2280-2282.

A mild killed steel, a mild carbon steel, a semihard Mn-Mo steel, and a mild Cr-Mo-Al-V steel were subjected to cold working, then immersed in solution of sodium chloride and hydrogen sulphide, with tensile stresses being simultaneously applied. Conditions of normal service were simulated as closely as possible, and respective intervals of time before rupture were recorded. Appearance of cracks was influenced by percentage of hydrogen ions in solution, prior cold working, amount and distribution of stress. (R1d, R6j; ST)

208-R.* (French.) **Use of Radioactive Isotopes in the Study of Metallic Corrosion in Alkaline Media.** Helmy Makram. *Comptes Rendus,* v. 246, Jan. 6, 1958, p. 99-101.

Specimens of electrolytically pure Cu were irradiated by means of an atomic pile, then immersed in solutions of NaOHN, trigon, or P₃Z. Passage of marked ions into solution was studied in function of time. (R11, 1-59; Cu-a)

209-R.* (French.) **On a Colloidal Interpretation of the Phenomena of Corrosion and Inhibition.** Jean Frasch. *Corrosion et Anti-Corrosion,* v. 6, Jan. 1958, p. 9-14.

Attempt to fit into electrochemical theory of corrosion and inhibition some of theories which have been advanced concerning colloidal nature of majority of products of corrosion. (R10b, 14-65)

210-R.* (French.) **Corrosion Phenomena in Tubular Condensers. Some Typical Examples, Correctives and Preventives.** A. J. Maurin. *Corrosion et Anti-Corrosion,* v. 6, Jan. 1958, p. 15-24.

Additional case histories; influence of microstructure of Cu alloys on corrosion susceptibility of condenser piping; a logometric apparatus that can be substituted for cathodic protection when latter is not feasible; brief listing of causes of condenser corrosion and of remedial measures available. (Concluded.) (R4, R10d; Cu, 4-60)

211-R. (French.) **Light Metals and Alloys in Corrosive Media.** J. Herenguel and Pierre Lelong. *Nature,* no. 3271, Nov. 1957, p. 445-450.

Nature of corrosion; laboratory methods of determining corrosivity; types of protection available; corrosivity of Al and Mg alloys, Be, Ti and Zr. (R-general; Al, Mg, *Be, Ti, Zr*)

212-R.* (French.) **Carbonate of Cyclohexylamine: Its Use as a Volatile Corrosion Inhibitor.** *Produits Chimiques,* v. 60, Nov. 30, 1957, p. 471-473.

Properties, including nontoxicity; applications to ferrous metals, either bare or plated with Cr, Ni, Monel metal, Pb, Zn or Al; corrosion protection afforded machinery during marine transport, industrial equipment during extended shutdowns, machinery and parts subjected to wear. (R10b)

213-R.* (French.) **Molybdenum Alloys and Their Protection Against Oxidation.** H. Buckle. *Recherche Aeronautique,* no. 61, Nov-Dec. 1957, p. 35-52.

Theoretical and practical problems of use of Mo alloys for heat engine parts. Above 500° C. protection must be provided by coatings. Those now available can be used at temperatures in excess of 1700° C., but are not entirely satisfactory when subjected to appreciable mechanical stresses. Best protective coatings now known are made of Ti, Pt and Cr; special Ni-Fe-Co-Cr alloys having unusually low coefficients of expansion; refractory alloys with Ni, Fe or Co bases, with underlying layer of Ti, Pt or Cr; and alloys containing elements susceptible of forming their own underlying layer, such as $MoSi_2$. Properties of coatings, methods of application and effectiveness of coatings as influenced by application technique. 29 ref. (R1h, L-general; Mo)

214-R. (French.) **Contribution to the Study of the Phenomenon of Frictional Erosion in Hydraulic Turbines.** T. Bovet. *Schweizer Archiv,* v. 23, Dec. 1957, p. 377-388.

Mechanism of abrasion. Study of deterioration of principal parts of Pelton, Francis, Kaplan turbines; preventive measures. (R1c, Q9p, W11n)

215-R.* (Italian.) **Research on the Oxidation of Metals and Alloys in the Molten State. Pt. 6. The Cadmium-Tin System.** Paolo Spinedi. *Gazzetta Chimica Italiana,* v. 87, Dec. 1957, p. 1420-1432.

Study by means of a continous recording thermic balance of oxidation behavior of binary alloys of Cd and Sn; investigation was extended to temperatures much higher than melting. Results discussed in terms of phase diagrams. Alloy containing about 5% Cd showed rather high resistance to oxidation, this property being ascribed to typical structure of the beta phase, which is stable in vicinity of above concentration, and the influence of which is still seen in the liquid phase. Includes study of oxide films as influenced by composition of respective alloys and characterized by decided morphological changes, especially in certain composition ranges. 7 ref. (R1h, M24; Cd, Sn, 14-60)

216-R.* (Italian.) **Research on the Oxidation of Metals and Alloys in the Molten State. Pt. 7. Zinc.** Paolo Spinedi. *Gazzetta Chimica Italiana,* v. 87, Dec. 1957, p. 1433-1439.

Study by continuous recording thermic balance of oxidation behavior of zinc in temperature range between 250-800° C. Oxidation mechanism is probably controlled by same laws in both solid and liquid states, although speed of process appears to be different for each state. Comparison of data obtained from similar studies conducted on other metals previously treated in this series. 20 ref. (R1h, Zn, 14-60)

217-R. **Stainless Steels for Corrosion Resistance.** L. R. Honnaker. *Chemical Engineering Progress,* v. 54, Jan. 1958, p. 79-82.

Causes, means of avoiding failures in stainless steel equipment resulting from pitting crevice corrosion, intergranular corrosion, stress-corrosion cracking and related phenomena where general corrosion is slight. 6 ref. (R1d, R2h, R2j; SS)

218-R. **Corrosion Problems in Pulp and Paper Mills—Present Day Answers.** D. F. Roberts. *Southern Pulp and Paper Manufacturer,* v. 21, Feb. 10, 1958, p. 84-87, 126.

(R2, L26, T29r; ST)

219-R. **Development and Properties of Uranium-Base Alloys Corrosion Resistant in High-Temperature Water. Pt. 4. Radiation Stability of Uranium-Base Alloys.** Westinghouse Electric Corp. *U. S. Atomic Energy Commission,* WAPD-127, Pt. 4, May 1957, 113 p.

27 ref. (R4, 2-62, 2-67; U, *Mo, Cb*)

220-R. **Inhibition of Hydrogen Corrosion of Uranium.** A. Kreig and J. M. Napier. Union Carbide Nuclear Company. *U. S. Atomic Energy Commission,* Y-1151, July 1, 1957, 37 p.

(R6q, R10b; U)

221-R. **Aqueous Corrosion of Zircaloy Clad Thorium.** S. Isserow. Nuclear Metals, Inc. *U. S. Atomic Energy Commission,* NMI-1191, Sept. 20, 1957, 25 p. (Available at U. S. Office of Technical Services, $.75.)

12 ref. (R4c, T11, Th, *Zr,* 8-66)

222-R. **Corrosion of Monel and 70-30 Cupronickel in Hydrofluoric Acid.** Walter J. Braun, Frederick W. Fink and G. Lee Ericson. Battelle Memorial Institute. *U. S. Atomic Energy Commission,* BMI-1237, Dec. 3, 1957, 18 p. (Available at U. S. Office of Technical Services, $.75.)

(R6g; Ni, *Cu*)

223-R.* (French.) **Search for a Substance With Combined Anti-Oxidizing and Corrosion Inhibiting Properties in Relation to Olein and Iron.** J. P. Sisley, M. Loury and C. Defromont. *Revue Francaise des Corps Gras,* v. 4, Mar. 1957, p. 149-154.

No product now in use in industry combines both properties. Diphenylpara-phenylenediamine and dibeta - naphtyl - para - phenylenediamine are composed of poly-functional molecules and could be used to develop type of product desired. 7 ref. (R10b; Fe)

224-R.* (Italian.) **On the Lag Interval in Hydrogen Reduction of Products of Oxidation of Metallic Iron at High Temperatures.** Agostino Bargone and Vittorio Gottardi. *Tecnica Italiana,* v. 12, Oct-Nov. 1957, p. 449-455.

Review of research on oxidation of iron and hydrogen reduction of resultant products; experimental observations which explain lag period observed during reduction. Lag is related to composition and morphology of the oxides and to temperature and duration of oxidation process. (R1h, 2-62; Fe)

(*)Articles Available Through Photocopy Service; See Coupon, p. 6_

S Inspection and Control

131-S. Spectrophotometric Determination of Iron With Ethylenediamine Di (o-Hydroxyphenylacetic Acid). A. L. Underwood. *Analytical Chemistry,* v. 30, Jan. 1958, p. 44-47.

(S11k; Fe)

132-S. Analysis of High-Purity Iron. R. E. Heffelfinger, D. L. Chase, G. W. P. Rengstorff and W. M. Henry. *Analytical Chemistry,* v. 30, Jan. 1958, p. 112-114.

Use of special concentrating techniques, such as ether separation and sulphide precipitation in conjunction with spectrographic analysis. 13 ref. (S11k, S11f; Fe-a)

133-S. Analysis of Zirconium/Cerium Binary Alloys. G. W. C. Milner and G. W. Sneddon. *United Kingdom Atomic Energy Authority,* A.E.R.E. C/R 1654, Sept. 16, 1957, 1 p.

6 ref. (S11j; Ce, Zr)

134-S. (German.) **Investigations of Hard Metals.** Christa Streil. *Chemische Technik,* v. 9, Nov. 1957, p. 672-675.

Determination of specific gravity, carbon and graphite content and metallic components.
(S11, S14j, P10a, SGA-q)

135-S. (German.) **Thickness Measuring of Electroplate.** G. Oelsner. *Metallwaren-Industrie und Galvanotechnik,* v. 48, Oct. 1957, p. 417-430.

Methods and instruments, construction and operation. 14 ref.
(S14, 1-53; 8-62)

136-S. (German.) **Determination of Hydrogen in Liquid and Solid Pig Iron.** K. Zimmermann and H. Uhlitzsch. *Neue Hütte,* v. 2, Oct. 1957, p. 607-616.

Pt. I: Iron-hydrogen system; sampling, analysis, apparatus. Pt. II: Hydrogen content and behavior. 80 ref. (S11, N1, 1-54, S12; CI-a, *H*)

137-S. (German.) **Determination of Structural Constituents of Steels.** W. Koch and H. Sundermann. *Radex Rundschau,* no. 5-6, 1957, p. 679-692.

Electrolytic dissolution for determination of ferrous components; new magnetic technique for separating residues. 10 ref.
(S11g; M23a, ST)

138-S. (German.) **New Electrolytic Method for Carbide Investigation in Carbon Steels.** T. Heczko. *Radex Rundschau,* no. 5-6, 1957, p. 711-724.

9 ref. (S11g; CN, *C*)

139-S. (German.) **Separation of Sulphides.** E. Artner. *Radex Rundschau,* no. 5-6, 1957, p. 725-726.

Magnetic separation method developed by W. Koch and H. Sundermann. (S11f; ST, *S*)

140-S. (German.) **Determination of Oxide Inclusions in Killed and Partly Killed, Carbon and Low-Alloy Steels.** E. Piper, H. Hagedorn, H. Kern and J. Ingeln. *Radex Rundschau,* no. 5-6, 1957, p. 727-737.

6 ref. (S11; ST, *O*, 9-69)

141-S. (German.) **Seam Weld Testing With Ultrasonics.** René Hornung. *Schweisstechnik,* v. 11, Sept. 1957, p. 103-106.

History, principles, equipment and operation for direct and resonance testing. Advantages over X-ray techniques are quick location and measurement of cracks and other defects in the whole length and depth as well as in the use of simple and economical equipment.
(S13g, 1-53, 7-51)

142-S. (German.) **Determination of Small Amounts of Molybdenum in Tungstates.** Christoph Winterstein. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 10, Nov. 1957, p. 549-551.

A new photometric method using sodium fluoride to keep tungstic acid in solution. (S11j; Mo)

143-S. (German.) **Ultrasonic Field and Its Importance for Testing Forgings by Immersion in Dipping Technique.** Josef Krautkrämer. *Zeitschrift für Metallkunde,* v. 48, Nov. 1957, p. 606-609.

(S13g, 1-74; 4-51)

144-S. (Slovenian.) **Application of Mathematical Statistics in Study of Uniform Constitution of Refined Steel.** Otmar Gautsch. *Nova Proizvodnja,* v. 8, Nov. 1957, p. 312-313.

(S12, 2-60; ST)

145-S. Should Ultrasonic Inspection Be Used to Augment Radiography in the Inspection of Weldments in High-Pressure Piping. R. L. Steele. *American Society of Mechanical Engineers,* Paper no. 57-A—195, Dec. 1957, 9 p.

(S13g, S13e; 7-51)

146-S. Ultrasonic Testing of Large Rotor Forgings. Criteria for Detecting Ability. S. Serabian and G. E. Lockyer. *American Society of Mechanical Engineers,* Paper no. 57-A—279, Dec. 1957, p. 2-10.

Factors influencing selection of suitable ultrasonic techniques; testing techniques for initial forging inspection and the finished rotor assembly. (S13g; 4-51)

147-S. Determination of Thorium in Ores With APANS-Meso Tartaric Acid Reagent After a Shortened Chromatographic Separation. D. A. Everest and J. V. Martin. *Analyst,* v. 82, Dec. 1957, p. 807-811.

14 ref. (S11a; Th, RM-n)

148-S. Molybdate Method for Determination of Phosphorus, Particularly in Basic Slag and in Steel. D. Stockdale. *Analyst,* v. 83, Jan. 1958, p. 24-36.

4 ref. (S11j; ST, RM-q, *P*)

149-S.* Methods for Rapid Determination of Silicon in Ferrosilicon. Sigurd Velken. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 119-121.

Two volumetric methods based on precipitation of Si as potassium fluosilicate followed by titration of this compound. The methods have a reproducibility equal to the conventional gravimetric methods and are far more rapid. 11 ref.
(S11j; *Si*, AD-n)

150-S.* Effect of Nitrides in Silicon Iron on the Determination of Oxygen by Chlorination, and the Possible Direct Determination of Aluminium Nitride. F. J. Armson and H. L. Bennett. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 132-137.

Silicon iron containing 4% Si and 0.3% Al has been analyzed for oxygen by chlorination in a vertical closed reaction chamber. The oxides are present almost entirely as alumina and silica, but a substantial proportion of the nitrogen is retained in the residue as aluminum nitride. Unless a correction is applied, a large error results in the oxygen content. The magnitude of the correction can be diminished by chlorinating at 600 instead of 500° C. 19 ref. (S11; Fe, *O*)

151-S.* Routine Determination of Oxygen in Steel Using a Carrier-Gas Fusion Technique. C. E. A. Shanahan and F. Cooke. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 138-142.

The sample is melted in a carbon crucible and the carbon monoxide evolved is extracted by a streaming carrier gas and not by vacuum pumps, as in the well known vacuum-fusion procedure. A determination may be made within 15 min. with a standard deviation of about 0.0016%. (S11r; ST, *O*)

152-S. Translator Control. W. N. Jenkins. *Iron and Steel Institute, Journal,* v. 188, Feb. 1958, p. 157-168.

Methods of controlling variables in the steel mill.
(S18, D-general, F23; ST)

153-S.* Rapid Titrimetric Analysis of White Metals. L. J. Ottendorfer. *Metallurgia,* v. 57, Feb. 1958, p. 105-106.

Highly accurate results are obtained in less than 1 hr. in the analysis of alloys of Sb, Sn, Pb and Cu, by a combination of bromatometric methods (for Sb and Sn) with complexometric methods (for Pb and Cu). (S11j, Pb, *Sb, Cu, Sn*)

154-S. X-Ray Emission Spectrographic Analysis of Bastnaesite Rare Earths. Farrel W. Lytle, James I. Botsford and Henry A. Heller. *U. S. Bureau of Mines, Report of Investigations* 5378, May 1957, 15 p.

23 ref. (S11p; EG-g)

155-S. (English.) **Flame Spectrophotometric Method for Determination of Nickel and Boron in Plating Solutions.** D. E. Fornwalt. *Analytica Chimica Acta,* v. 17, Dec. 1957, p. 597-603.

(S11k, L17a; *B, Ni*)

156-S. (French.) **Determination of Nitrogen in Carbon or Special Steels.** Rene Castro, Jacques Allemand and Rene Poussardin. *Analytica Chimica Acta,* v. 17, Dec. 1957, p. 530-534.

4 ref. (S11j; ST, *N*)

157-S. (Japanese.) **Spectrochemical Analysis With the Universal Source Unit. Pt. 5. Determination of Lead in High-Purity Zinc.** Kasuo Yasuda. *Japan Analyst,* v. 6, Dec. 1957, p. 768-744.

4 ref. (S11k; *Pb*, Zn-a)

158-S. (Japanese.) **Electrochromatography. Pt. 19. Separation and Quantitative Estimation of Rare Earths in Monazite Sand by Electrochromatography.** Masafumi Maki. *Japan Analyst,* v. 6, Dec. 1957, p. 779-782.

8 ref. (S11a; EG-g)

159-S.* Use of Ultrasonic Testing for the Control of Quality in the Manufacture of Aluminium Alloys and Other Non-Ferrous Materials. J. G. Harris and J. Crowther. *Institute of Metals, Journal,* v. 86, Jan. 1958, p. 193-206.

Ultrasonic testing in final inspection and at earlier stages in processing has led to a marked improvement in the quality of high-strength Al alloy plate, extrusions and forgings. Characteristic defects of cast and wrought material in relation to their location and evaluation by available methods; precise evaluation of defect signals is generally not to be expected. Techniques should be carefully chosen to suit the nature and geometry of the product and the standard of inspection required. 29 ref. (S13g; Al)

160-S.* Recent Advances in Radiographic Techniques. R. Halmshaw. *Institute of Metals, Journal,* v. 86, Jan. 1958, p. 207-211.

Technique and extensions of the scope of radiography, particularly

higher-power X-ray sources and of radioisotopes. Methods being developed to reduce the cost and increase the speed of radiography include fluoroscopy, electronic image-intensifiers, miniature-film recording techniques, use of X-ray paper, Xeroradiography, ionography and scanning with counters. 20 ref.
(S13e, X8)

161-S. Assessment of Surface Finish. *Iron and Steel,* v. 31, Feb. 1958, p. 63-64.

Determination of surface finishes to about 1 micro-in. can be made much more rapidly with new interference microscope than with conventional methods. (S15d, X3q)

162-S. Measurement of Paint Thickness on Aircraft. N. R. Keegan. *Machinery* (London), v. 92, Jan. 17, 1958, p. 156.

Paint layer on high-speed aircraft, in addition to being smooth, must be of uniform thickness to close limits. Advantages of recently modified Boonton gage which measures paint thicknesses accurately and conveniently.
(S14h, T24a, X20c, NM-g)

163-S. Fundamentals of Differential Radiation Measurements. Richard F. Nickerson. *Nondestructive Testing,* v. 16, Jan-Feb. 1958, p. 24-27, 41.

Mathematical treatment of absorption processes; factors which affect ability of user to discriminate between small differences. (S13e)

164-S. Frequency Selection for Eddy Current Testing. B. H. Robinson. *Nondestructive Testing,* v. 16, Jan-Feb. 1958, p. 36-39.

For testing nonmagnetic rods, tubes and wires for longitudinal cracks, by means of annular coils, the best criterion is signal-to-noise ratio; other factors in selection are sample diameter, sample conductivity, character and location of defect, speed of inspection and instrumentation employed. (S13h)

165-S. Modern High Speed Radiographic Technics Speed and Simplify Douglas Inspection. E. W. Makin. *Nondestructive Testing,* v. 16, Jan-Feb. 1958, p. 42-43.

New X-ray techniques used for inspection of control surfaces and inaccessible structural segments of air frames, for debris, cracks and structural failures. (S13e, T24a)

166-S. (German.) **Interference Microscope Investigation on Bright Metal Surfaces.** E. Raub. *Werkstattstechnik und Maschinenbau,* v. 48, Jan. 1958, p. 37-40.

Various methods of polishing, testing results by means of interference microscopy. (S15d, 1-53, X3q)

167-S. (Italian.) **Determination of Lead, Thallium and Bismuth by Distribution in Counter-Current.** Antonio Catino and Maddalena Maletto. *Rassegna Chimica,* v. 6, Sept-Oct. 1957, p. 3-10.

New microchemical method for rapid analysis of alloys containing these elements; experimental determination and theoretical calculation of curves of distribution in counter-current; effect of pH and concentration of coefficients of distribution. By varying the concentration of hydrogen ions it was possible to determine coefficients of distribution of the dithizone-treated metals studied and to establish the optimum separation that occurs around pH 4.54. 10 ref. (S11d; Bi, Pb, Th)

168-S. (French.) **Rapid Determination of Lead in the Sulphate State in Antifriction Alloys.** E. Garate and T. Garate. *Chimie Analytique,* v. 40, Jan. 1958, p. 7-10.

Simple, accurate method requiring no previous separation of other components; can be used equally well on Sb-Pb alloys, tin solders and bronzes; uses diluted nitric and hydrofluoric acids. 10 ref.
(S11j, S11k; Pb)

169-S. (French.) **New Method for Analyzing Copper Alloys.** M. Kuhn. *Chimie Analytique,* v. 49, Jan. 1958, p. 11-19.

Method based on complete dissolution of bronzes in nitrofluoboric medium has been tested on tin bronzes, has wide application. (To be continued.) (S11j; Cu-s)

170-S. (German.) **Bearing Material Testing. Pt. 1.** R. Weber. *Metall,* v. 12, Feb. 1958, p. 96-103.

Physical, mechanical ("volumen") and surface properties. Testing machines and methods; evaluation of materials on the basis of their volume. (S14, Q-general; SGA-c)

171-S (German.) **Turbidimetric Determination of the Tin Content in High-Purity Zinc and Zinc Alloys.** H. Pohl. *Metall,* v. 12, Feb. 1958, p. 103-105.

(S11j; Zn, *Sn*)

172-S. (Japanese.) **Photometric Determination of Small Amounts of Nickel in Ores.** Hiyoshi Isono. *Japan Analyst,* v. 6, Sept. 1957, p. 557-561.

Improvements on the E. B. Sandell method of colorimetric determination of Ni in chloroform.
(S11a; Ni, RM-n)

173-S. (Japanese.) **Rapid Determination of Ferrophosphorus.** Shigeo Wakamatsu. *Japan Analyst,* v. 6, Sept. 1957, p. 579-582.

(S11j; P)

T Metal Products and Parts

104-T. Materials for "Hot" Rocket Parts Must Withstand 1700° F. Plus. R. C. Kopituk. *Aviation Age,* v. 28, Jan. 1958, p. 104-109.

(T2p, 17-57; SGA-h)

105-T. Machining With a "Throw-away" Insert. H. B. Iron. *Design Engineering,* v. 4, Jan. 1958, p. 36-39.

Use of "throw-away" solid carbide insert holders for carbide cutting tools eliminates cutter or tool sharpening operations and reduces costs.
(T6n, W25d, 1-52)

106-T. Aluminium Busbars. H. B. Grainger and R. J. Watkins. *Engineering,* v. 184, Dec. 13, 1957, p. 744-748.

Development of new alloy which overcomes mechanical and electrical difficulties in use of Al busbars.
(T1b, 17-57; Al)

107-T. Manufacture of Thin-Walled Leaded-Copper Bearings. G. K. Ogale and P. R. Abhyankar. *Indian Institute of Metals, Transactions,* v. 10, 1956-57, p. 187-194.

Process studies; preparation of bearings; performance test. 21 ref.
(T7d; Cu, *Pb*)

108-T. Production of Components for Lambretta Motor Scooters. *Machinery,* v. 92, Jan. 10, 1958, p. 60-73.
(T10h, G-general, 1-52)

109-T. Vertical Take-Off and Landing. Lawrence J. Hull. *Metal Progress,* v. 73, Feb. 1958, p. 68-71.

Thrust from a powerful jet engine gives vertical take-off; control of direction is by slight changes in the direction of the main exhaust and stability against roll is by jet reaction controls, all electrically interlinked at the pilot's fingertips.
(T24, 17-57)

110-T. Steels for the Petroleum Industry. F. A. Kirk. *Petroleum,* v. 21, Jan. 1958, p. 19-25.

Detailed comparison of the corrosion and heat resisting steels specified in Great Britain and the U.S.A. for use in the petroleum industry.
(T29n, T28, 17-57; ST, SGA-g, SGA-h)

111-T. Western-Made High-Precision Instrument Bearings. Penn DeRoche. *Western Machinery and Steel World,* v. 49, Jan. 1958, p. 72-76.

(T7d, G general; SS)

112-T. (German.) **Nickel-Molybdenum Alloys in the American Chemical Industry.** G. R. Barrow. *Chemische Rundschau,* v. 10, Dec. 16, 1957, p. 561-564.

(T29, 17-57; Mo, Ni)

113-T. (German.) **Experiences With Steel Framework in the Tunnels of the Iron Mine Friederike.** W. Fritzsche. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 10, Nov. 1957, p. 543-549.

(T28m, 17-57; ST)

114-T. Silver-Indium-Cadmium Alloy Control Rods for Pressurized Water Reactor. E. F. Losco, I. Cohen and R. R. Eggleston. *American Society of Mechanical Engineers,* Paper no. 57-A—230, Dec. 1957, 12 p.

8 ref. (T11j, 17-57; Ag, Cd, In)

115-T. Titanium Fasteners. R. T. Allsop. *Aircraft Production,* v. 20, Jan. 1958, p. 2-8.

(T7f, 17-57; Ti)

116-T. Titanium for Missile Applications: Pt. 1. B. L. Baird and C. W. Handova. *Industry and Welding,* v. 81, Feb. 1958, p. 40-41, 89-90.

(T24e, 17-57; Ti)

117-T. Boron Steel for Control Rods and Thermal Shields. Nicholas Balai. *Nucleonics,* v. 11, Jan. 1958, p. 100-101.

(T11j, 17-57; ST, *B*)

118-T. Metallurgy and the Plastics Industry. *Rubber and Plastics International Journal,* v. 133, Dec. 28, 1957, p. 1020-1024.

Recent developments in metallurgy as they relate to plastics industry; ductile cast iron, cold extruded steel, ductile Ni-Cr cast iron, glass-steel bonded storage tanks and Vinyl coated steel. (T29s, 17-57)

119-T. Will Gears Operate at 600° F? E. E. Shipley. *American Machinist,* v. 102, Feb. 10, 1958, p. 101-103.

Dynamic testing of gear materials and lubricants indicates future success with Nitralloy-N and synthetic or metallic lubricants.
(T7a, 17-57; AY, SGA-h, NM-h)

120-T. Evaluating Ceramic Tools. Pt. 2. D. R. Kibbey and W. T. Morris. *Automatic Machining,* v. 19, Feb. 1958, p. 42-44.
(T6n, 17-52; Al, 6-70)

121-T. What We Need in High Temperature Materials. Pt. 1. A. J. Carah. *Iron Age,* v. 181, Jan. 23, 1958, p. 75-77.

Limitations of Al, Mg, Ti and steel alloys present urgent need for development of alloy-lean, heat resistant steels for aircraft and missile production. (T24, 2-62, 17-57; SGA-h, Al, Mg, Ti, AY)

122-T. High Strength Cast Alloys Used for Low Cost Jet Fighter Parts. *Western Metalworking,* v. 16, Jan. 1958, p. 63.

(*)Articles Available Through Photocopy Service; See Coupon, p. 6

Aluminum castings for fuel tank pylons and canopy breakers are stronger, lighter and less expensive than parts machined from bar stock. (T24, 17-57; Al, 5-60)

123-T. Development of Electric Cable Manufacture. C. G. Gorton. *Wire Industry*, v. 25, Jan. 1958, p. 67-68.

(T1b, 17-57; Al, NM-d)

124-T. (French.) **Strength of Monobloc Tanks.** R. Epain. *Metallurgie et la Construction Mecanique*, v. 90, Jan. 1958, p. 15-23.

Calculations for construction of banded monobloc tanks for high-pressure service. Stresses, equilibrium equations, elastic strength, banding and banding with wire in monobloc vessel. (To be continued.) (T26q)

125-T. (Hungarian.) **New Hard Lead Alloys for Battery Grids.** Laszlo Pesthy. *Kohaszati Lapok*, v. 12, Jan-Feb. 1957, p. 53-57.

Hard lead is an alloy of Pb and Sb. Antimony may be replaced by Pb-Ca alloys, Cd, Te and Li. 4 ref. (T1, 17-57; Pb, *Ca, Cd, Li, Te*)

126-T. (Russian.) **Hard Metal Spiral Tools.** N. A. Rozno. *Stanki i Instrument*, v. 28, Nov. 1957, p. 29-32.

Tools for working corrosion resistant and tempered steels and alloys of unusual toughness and strength. (T6n, G17; SGA-g, ST)

127-T. Materials for Superheater Tubes and Supports. D. W. Crancher. *Institute of Marine Engineers*, Advance Copy, Jan. 14, 1958, p. 1-18.

Qualities of six tube steels developed for use for superheater tubes and supports for boilers. Creep and corrosion resistance, mechanical strength, use of welding, availability. 41 ref. (T22h, W11k, 4-60, R2g, Q3; ST)

128-T. Iron-Ore Handling and Preparation. Use of Conveyors at East Moor Works of Guest Keen Iron and Steel Co., Ltd. T. H. Keen. *Iron and Coal Trade Review*, v. 176, Jan. 24, 1958, p. 197-202.

(T28r, W12r, 1-52; Fe, RM-n)

129-T.* A Progress Report on Titanium-Alloy Fasteners. John Van Hambersveld. *Machine Design*, v. 30, Jan. 23, 1958, p. 123-127.

Major advances in heat treating and fabrication techniques have combined to produce high-strength fasteners with good fatigue resistance under aerodynamic loads. (T7f, 17-57; Ti)

130-T.* Properties, Application, and Examination of Ferrous Metals Used in Colliery Engineering. J. Pettit. *Mining Electrical and Mechanical Engineer*, v. 38, Jan. 1958, p. 195-204.

Types of metal, tests used to show characteristics, heat treatment and applications, with some design data; examination during use and wear. 17 ref. (T28, 17-57; ST, CI)

131-T.* Piping Systems and Metallurgy for Nuclear Applications. *Power Engineering*, v. 61, Dec. 1957, p. 114-118.

Basic mechanism of radiation damage and its manifestations (vacancies, thermal spikes, interstitials, impurity atoms, radiation effects); effects on piping design and metals used in piping systems, especially where primary loops are involved; corrosion problems in nuclear systems; relative merits of steel castings versus forgings for primary loop applications. (T11p, 17-57, M25, M26, 2-67)

132-T. Plutonium-Aluminum Fuel Element Development. M. D. Freshley. Hanford Atomic Products Operation. *U. S. Atomic Energy Commission*, HW-52457, Sept. 18, 1957, 44 p.

21 ref. (T11g, 17-57; Pu, *Al*)

133-T. Zirconium Moderator Reflector Can Development for the SRE. J. A. Leppard. Atomics International. *U. S. Atomic Energy Commission*, NAA-SR-2006, Dec. 15, 1957, 35 p. (Available at U. S. Office of Technical Services, $.30.)

The graphite moderator used in the Sodium Reactor Experiment is sealed against the liquid sodium coolant by being enclosed in Zr cans. The cans are fabricated of hafnium-free unalloyed Zr sheet, 0.035 and 0.100 in. thick. Fabrication procedures, welding techniques and sequences, testing of full-size assemblies, and extensive investigation and testing of the can head structure. 4 ref. (T11h, G1, K1d, 17-57; Zr)

134-T.* (German.) **Hard Metal Tools for Reshaping and Cutting.** J. Witthoff. *Draht*, v. 8, Nov. 1957, p. 465-470.

Properties of hard metals. Advantages for tools include precise machining, high-quality products, time saving, low production costs. Mostly tungsten carbide-cobalt alloys are used. Tungsten content influences favorably the hardness, cobalt content increases bending strength. (T6n, Q-general, G17; W, Co, 6-69)

135-T.* (German.) **Recent Experiences With Multi-Purpose Hard Metals.** J. Witthoff. *Werkstattstechnik und Maschinenbau*, v. 47, Nov. 1957, p. 603-610.

Composition and properties of various types of hard metal tools. (T6n, Q-general; SGA-j, 6-69)

W Plant Equipment

128-W. Operations at Mount ISA Copper Smelter by the Smelter Staff. *Australasian Institute of Mining and Metallurgy, Proceedings*, no. 183, Sept. 1957, p. 17-42.

(W18r, C21, 1-52; Cu)

129-W. Performance Analyses of Screens, Hydrocyclones, Jigs and Tables Used in Recovering Heavy Accessory Minerals From an Intensely Decomposed Granite on the Jos Plateau Nigeria. F. A. Williams. *Institution of Mining and Metallurgy, Bulletin, Transactions*, v. 67, Pt. 3, 1957-58, p. 89-108.

(W15p, B14m, 1-52)

130-W. Time-Saving Methods in Modern Smelteries. C. C. Downie. *Mining Journal*, v. 249, Dec. 27, 1957, p. 772-773.

Study of chain-belt system used in refining of metals in U. S. A. 9 ref. (W12r, C21, 1-52)

131-W. Plastics in the Toolroom. *Steel*, v. 142, Feb. 3, 1958, p. 108-111.

Various properties offered by varying compositions of epoxy resins in dies and die caps. (W22a, W24n, 17-57; NM-d)

132-W. (German.) **Simple Means of Transportation in the Foundry.** Werner Riege. *Giesserei*, v. 45, Jan. 1958, p. 23-25.

Equipment for conveying and supporting. (W12r, W19b, 1-52, 18-67)

133-W. (Russian.) **Cooler Plates in Shaft of Blast Furnaces.** S. M. Andoney, G. A. Kudinov and S. M. Liderman. *Metallurg*, Dec. 1957, p. 8-9.

(W17g, W10f, 1-52)

134-W. (Russian.) **Screening the Heat Resistant Tuyere Nozzles of Blast Furnaces.** L. Ya. Shparber. *Metallurg*, Dec. 1957, p. 13.

Guarding the tuyere nozzles at temperatures of 800° and more prevents their deformation, conserves heat and saves on coke. (W17g, D1b)

135-W. (Russian.) **Preparing the Teeming Ladle for Steel From Furnace.** G. M. Guzenfeld and L. G. Korolev. *Metallurg*, Dec. 1957, p. 24-25.

New method of preparing teeming ladle with oxygen and elimination of preliminary cooling. (W19b, 1-52; ST)

136-W. (Russian.) **Speedy General Overhauling of Large Capacity Electric Furnaces.** M. G. Dmitrienko. *Metallurg*, Dec. 1957, p. 33-34.

Erection of temporary scaffold bridges which permits simultaneous working of all crews thus substantially reducing time for overhaul. (W17j, 18-72)

137-W. (Russian.) **Performance of Ural Sheet Mills.** N. I. Gubashev. *Metallurg*, no. 12, Dec. 1957, p. 33-34.

(W23c, 1-52; ST)

138-W. (Russian.) **Induction Furnaces of Industrial Frequencies.** V. S. Astaulov. *Liteinoe Proizvodstvo*, Dec. 1957, p. 5-8.

Compares induction furnace of crucible type with that of tubular furnace with iron core. Advantages of former in economy of fuel and quality of production. (W18a, 1-52)

139-W. (Russian.) **Modernization of Duplicate Milling Machines.** M. B. Tumarkin. *Stanki i Instrument*, v. 28, Nov. 1957, p. 14-16.

(W25r, 1-52)

140-W. (Russian.) **New Radial Drill Machinery at the Odessa Plant.** B. M. Bromberg. *Stanki i Instrument*, v. 28, Nov. 1957, p. 37-39.

(W25p, 1-52)

141-W. Rolling Mills for Fuel Elements. A. I. Nussbaum. *Atomics and Nuclear Energy*, v. 9, Jan. 1958, p. 16-19.

Rolling and fabrication of the many new elements required for atomic age. Requirements of special equipment, avoidance of radioactive hazards and knowledge of special properties of materials. (W23c, 1-52, T11; *Pu*)

142-W. 10 Advantages of Rapid Heating of Steel. Quentin M. Bloom. *Industrial Gas*, v. 36, Jan. 1958, p. 4-5.

(W27g, J-general; ST)

143-W. Blooming Mill Controls. M. P. Rathbone. *Iron and Coal Trades Review*, v. 176, Jan. 3, 1958, p. 19-25.

Developments in automation and punch-card techniques applied to operation of heavy rolling mills. Russian advances compared. (W23a, S-18, 1-52, 18-74; ST)

144-W. Ultrasonic Drilling. *Mass Production*, v. 34, Jan. 1958, p. 73-75.

A new machine tool that will tap a thread ½ in. deep in tungsten carbide in 15 min. (W25p, 1-74)

145-W. New Double-Duo Bar Mill. *Metallurgia*, v. 57, Feb. 1958, p. 94-96.

(W23d; ST)

146-W. Progress at Ford's New Foundry. *Process Control and Automation*, v. 5, Jan. 1958, p. 14-18.

(W19, E-general, 18-67)

147-W. Reverberatory Aluminium Holding Furnace. *Refractories Jour-*

nal, v. 33, Dec. 1957, p. 547-549.
(W19a, 1-52; Al)

148-W. (Hungarian.) **Modern Molding Machines.** Lajos Kalman. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 81-87.
(W19h)

149-W. (Hungarian.) **Modern Roll Designing. Grooving of Rolls for Structural Shapes.** Jenö Mercader. *Kohaszati Lapok,* v. 12, Apr-May 1957, p. 150-156.
(W23k, 17-51)

150-W. (Hungarian.) **Shop Experiments on Graphite Crucible Life.** Karoly Maréchal. *Kohaszati Lapok,* v. 12, July 1957, p. 158-163.
(W18c; NM-K36)

151-W. (Hungarian.) **Production of Dynamo and Transformer Sheets.** Ernö Neuhöffer. *Kohaszati Lapok,* v. 12, July 1957, p. 289-291.
(W11q, W11r, 17-57; ST, SGA-n, 4-53)

152-W. Descaling Line Cuts Stock Costs. *Iron Age,* v. 181, Jan. 23, 1958, p. 86-87.
(W2r, L10c, 1-61; ST)

153-W.* Magnetic Separators. A. L. Wilson, Jr. *Iron and Steel,* v. 31, Feb. 1958, p. 71-72.
Magnetic separators used to decontaminate cold rolling mill coolant reduce cleaning time, eliminate much streaking on rolled steel, and possibly increase the life of oil seals and bearings. (W23p, 1-52; NM-h)

154-W. (German.) **New Openhearth Steel Plant No. 3 of the Hoesch-Westfalenhütte AG, Dortmund.** Hans von der Warth, Georg Henke, Ernst Wiegand and Wilhelm Nellen. *Stahl und Eisen,* v. 78, Jan. 23, 1958, p. 79-87.
(W18r, D2, A5b, 10-55)

155-W. (German.) **Full-Continuous Medium Strip Rolling Mill at the Th. Wuppermann GmbH Plant, Lever-Kusen.** Heinrich Lampmann. *Stahl und Eisen,* v. 78, Feb. 6, 1958, p. 160-167.
(W23c, F23, 1-61)

156-W. (Hungarian.) **Significance of Basic Lined Hot Blast Cupola for Openhearth Establishments.** Ferenc Varga. *Kohaszati Lapok,* v. 12, Jan-Feb. 1957, p. 24-30.
7 ref. (W18c, W18r, 1-52; RM-h)

157-W. Automatic Gauge Control in Cold Strip Rolling Mill. *Instrument Practice Automation and Electronics,* v. 12, Jan. 1958, p. 57-61.
(W23c, X20c; Cu-n)

158-W. Push-Button Steel. *I. S. A. Journal,* v. 5, Feb. 1958, p. 66-67.
A card programmed control system makes rolling equipment completely automatic. Thickness is measured by X-ray.
(W23c, S18, X20c, ST)

159-W. New Bar Mill. *Iron and Steel,* v. 31, Feb. 1958, p. 53-55.
The mill, a five-stand double duo type fitted with roller bearings, will replace two existing mills and be used for rolling high speed tool and alloy steel bars to close dimensional tolerances. (W23d, 1-52; TS, AY)

160-W. (German.) **Induction Furnace for Melting of Heavy and Light Metals.** J. Tostmann. *Zeitschrift für Metallkunde,* v. 48, Dec. 1957, p. 641-646.
Construction of line frequency induction furnaces. Melting of Cu and Zn cathodes in large furnaces. The submerged resistor-type improved by straight melting channels is preferred for melting of light metals. New refractory lining materials.
(W18a, 1-52; Cu, Zn)

161-W. (German.) **Line Frequency Induction Crucible Furnace for Melting of Nonferrous Alloys.** H. Rohm. *Zeitschrift für Metallkunde,* v. 48, Dec. 1957, p. 650-654.
(W18a, 1-52; SGA-a38)

X Instrumentation

Laboratory and Control Equipment

26-X. (Russian.) **Technical Measuring Methods in Machine Building.** D. D. Malyi. *Stanki i Instrument,* v. 28, Nov. 1957, p. 4-7.
Advances in measuring instruments, including extensive use of electronic devices, have contributed to raising metalworking industry to new level. (X general, 1-52)

27-X. Baldwin Automatic Control System for a Rolling Mill. *Machinery* (London), v. 92, Jan. 17, 1958, p. 157-158.
(X20c, W23c, 18-74; Cu, ST)

28-X. (German.) **Measuring Methods and Instruments for the Control and Location of Faults of Electrical Installations in Ironworks.** Kurt Stahl. *Stahl und Eisen,* v. 78, Jan. 23, 1958, p. 94-100.
(X10, X25, D-general)

(*)Articles Available Through Photocopy Service; See Coupon, p.

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers: c/o A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

POSITIONS OPEN

East

POWDER METALLURGIST: Excellent opportunity to "get in on the ground floor" of a newly formed research department. We are a fully integrated steel mill now entering the iron powder market. Desire good experimentalist and idea man with basic powder metallurgy experience. Adjacent to top residential areas in suburban Philadelphia. Send resume to: R. A. Lubker, Director of Research, Alan Wood Steel Co., Conshohocken, Pa.

Midwest

SALES REPRESENTATIVE: Progressive growing electric furnace company requires additional representation in the Minneapolis, St. Louis or Kansas City areas. Must know furnace field thoroughly and must have no competing line. Ample help will be given in reestablishing these territories. Our company is the oldest in its field and is still growing. We need aggressive experienced sales representation to help us continue this growth. Box 4-5.

METALLURGIST: Physical or mechanical. Interesting opportunities in a closely knit research and development laboratory in the following project areas: (1) Research on beryllium alloys for structural applications in aircraft and missiles. (2) Fabrication methods development for wrought beryllium components. Prefer metallurgist, physicist or mechanical engineer with graduate studies and/or research experience. Call EN 1-5400, Cleveland, or send complete resume in confidence to: Employment Manager, The Brush Beryllium Co., 4301 Perkins Ave., Cleveland 3, Ohio.

TOOL METALLURGIST: Nationally known metal fastenings manufacturer has excellent opening for metallurgist with a degree and 2-3 years experience including some time spent on tooling to work in newly created position of tool metallurgist. Will be given responsibility to develop and carry out a program of tool material selection, tool and die heat treatment; make studies on the productivity of tools and recommendations on tool design. Replies will be held in strict confidence. They should include details of education, work experience, salary information. Box 4-95.

Southwest

SALES REPRESENTATIVE: Salt bath furnaces—Texas, Louisiana, Oklahoma territory available from major manufacturer. Agent with metallurgical background calling on metalworking and aircraft plants required. Box 4-100.

Southeast

ROLLING MILL SUPERINTENDENT: A growing company has a position for a man looking to the future. This man must be able to perform and supervise heating and rolling of low carbon steels through high-temperature corrosion resistant alloys. Age to 35. Technical graduate preferred. Please give complete resume in first letter. Box 4-10.

Government

METALLURGISTS: The Naval Air Material Center is engaged in an extensive program of aeronautical research, development, experimentation and test operations for the advancement of Naval aviation. The Center needs metallurgists (salaries $5335 to $8645 per year) for work on high-strength steels, precision castings, heat resisting alloys, oxidation resistant coating for molybdenum, inert and shielded metal arc and resistance welding. Positions include research, development and evaluation-type duties. Interested persons should file an Application for Federal Employment, Standard Form 57, with the Industrial Relations Dept., Naval Air Material Center, Naval Base, Philadelphia 12, Pa. Applications may be obtained from above address or information as to where they are available may be obtained from any first or second-class post office.

POSITIONS WANTED

WELDING ENGINEER: Graduate, age 33, married, family. Six years in aircraft welding including research, production and quality control. Well experienced in welding aluminum alloys, alloy steels and titanium. Desires employment with aircraft or missile manufacturer or major subcontractor having need of such a man in a southern location. Box 4-15.

METALLURGICAL ENGINEER: B.S., B.A. degrees, chemistry, physics. Age 31. Seven

years diversified experience in metallurgical research and development. Major areas include: metallography, mechanical testing and evaluation, high-temperature materials, powder metallurgy and friction phenomena. Desires industrial position with administrative and technical responsibilities in metallurgical product or process development. Cleveland area desired. Box 4-20.

MANAGEMENT GROWTH DESIRED: M.S. in metallurgical engineering, B.S. in mechanical engineering, plus formal management training. Specialization in castings, ferrous and nonferrous. Experienced in production, supervision, sales liaison, research and development, customer consultations. Currently employed in high-caliber specialist position but desires growth opportunity. Will consider partnership in right venture. Box 4-25.

SALES ENGINEER: Engineering degree with eight years in research and production of alloy steels. Ten years in promotion and sales of ferro-alloys, titanium and nickel metal, chemicals and refractories. Desires to represent aggressive organization. Box 4-30.

PHYSICAL METALLURGIST: Ph.D., age 29, married, family. Desires associate or assistant professorship in metallurgy. Two years research experience in light metals industry plus three years teaching experience on full-time staff of large university. Will send resume on request. Box 4-35.

METALLURGICAL ENGINEER: B.S. degree, with nine years diversified experience (including considerable welding background) in ferrous and nonferrous metallurgy in Canada and U. S. A.E.C. clearance in Canada and U. S. Married, two children, age 32. Willing to relocate, travel. Best references. Complete resume on request. Available immediately. Box 4-40.

APPLICATION ENGINEER: Diversified experience in ferrous and nonferrous production metallurgical processes and materials. Promotion of heat treat and chemical processes through technical publications and sales engineering. Broadly traveled both geographically and industrially. Desires nondefense position requiring combined business and engineering background. Box 4-45.

BLACKSMITH AND FORGING SHOP FOREMAN: Indian, 36 years old, married, with

A Lecture Series on

MATERIALS FOR NUCLEAR REACTORS

will be held at
New York University
June 9 to 13, 1958

This special one-week course for engineers will consist of twenty lectures by experts in the field, and will cover the following areas:

- Criteria for Materials Selection
- Properties of Materials for Reactor Applications
- Environmental Effects (including Radiation Effects)
- Fuel Materials and Systems
- General Problems in Reactor Component Design

Informal discussion sessions will be held, including a special panel discussion on fuel selection for commercial power development.

Registrants may enroll for single days or the full course. Dormitory space will be available. Registration will be limited. Fees: Full course, $110; single day, $35; dormitory, $2.50 a night.

For information contact Course Chairman, Dr. Irving Cadoff, College of Engineering, New York University, New York 53, N. Y. Phone: LUdlow 4-0700, Extension 215.

CHALLENGING OPPORTUNITIES

in Materials Research and Development for Nuclear Propulsion Systems

We can offer exceptional opportunities to men with the ability to work on difficult problems in materials research and development for nuclear propulsion systems. There will be the mental stimulation of working beyond the boundaries of current technical knowledge.

The facilities of the Connecticut Aircraft Nuclear Engine Laboratory of Pratt & Whitney Aircraft are completely new. Research and development equipment is exceptional—both in quantity and quality. At CANEL you'll find the challenge, the encouragement, and the equipment to help you do your best work and earn the rewards of accomplishment. It will pay you to investigate.

METALLURGISTS

SUPERVISOR, JOINING DEVELOPMENT . . . to direct research and development of welding, brazing, cladding, and diffusion-bonding activities. At least six years' experience in allied research and development. Advanced degree desirable but equivalent research experience more essential.

SUPERVISOR, METALLURGICAL DEVELOPMENT . . . to direct alloy development programs. Work will include melting and fabrication and coordination of test evaluation. Ph. D. level desirable. At least six years' experience in similar work will be acceptable with a B.S. degree.

SUPERVISOR, METALLURGICAL RESEARCH . . . to direct research work in metal compounds, diffusion studies, phase equilibria work, and theoretical metallurgy consultation with other laboratory programs. Ph. D. level or equivalent required.

SUPERVISOR, FABRICATION DEVELOPMENT . . . to direct development of duplex structures by extrusion, rolling, or pressing. Cladding studies, development and preparation of cermets. B. S. or M. S. with strong background and at least six years in relevant work required or Ph. D. with two or three years of experience.

METALLURGICAL ENGINEER . . . to do liaison work between design, experimental manufacturing and the laboratories. Duties will include close follow-up of all materials development programs and coordination with shop operations. At least three years' applicable experience with B. S. or M. S. in metallurgical engineering.

METALLOGRAPHER . . . to conduct metallographic investigations of materials and to coordinate with other laboratory activities. Candidates should possess a strong interest and at least three years' experience in metallography as related to x-ray diffraction, phase equilibrium relationships, and properties. B. S. or M. S. degree in metallurgy.

RESEARCH METALLURGIST . . . to assist in metallurgical research programs including alloy development, metal compounds, diffusion studies, and phase diagram studies. Advanced degree desirable or B. S. with at least three years' experience in applicable work.

METALLURGISTS . . . recent graduates for work in materials testing, materials development, and non-destructive inspection development.

CHEMISTS

SUPERVISOR, ANALYTICAL CHEMISTRY . . . to direct analytical research and development and to supervise routine analytical work. Problems include analysis of trace elements in metals and gases, liquid metal analysis, advanced techniques using wet chemical methods. At least six years' experience in similar work required. Ph. D. level or equivalent.

RESEARCH CHEMIST, INSTRUMENTAL ANALYSIS . . . to work on development of spectrographic methods, including emission, x-ray fluorescence, and mass spectroscopy. X-ray diffraction experience desirable. At least three years of applicable experience. Advanced degree desirable.

RESEARCH CHEMIST, PHYSICAL CHEMISTRY . . . to assist in high-temperature chemical research and development programs including determination of physical properties and of solubilities. Candidate should possess an advanced degree with at least three years of applicable experience.

CHEMICAL ENGINEERS OR CHEMISTS . . . to assist in development work in analytical chemistry, physical chemistry, or corrosion. Recent graduates.

Please send complete resume to Mr. L. T. Shiembob, Office 3, Employment Department.

PRATT & WHITNEY AIRCRAFT
CANEL

Box 611, Middletown, Conn.

15 years association with reputable forge and smith shops in India, considerable knowledge and experience in engineering practice relating to manufacture and maintenance of equipment. Desires change with view to expanding progress in drop and heavy forgings. Box 4-50.

STAFF METALLURGIST: Ten years in hot and cold forming processes (forging, extrusion, etc.), seven years in castings. Laboratory-plant liaison feasibility surveys, development, cost reduction, training, metallurgy, production supervision, troubleshooting. Can ably handle men, speak before groups. Publications, traveled widely. B.S. degree, age 41, married, family. Desires responsible position requiring knowledge, judgment, initiative. Box 4-55.

STAINLESS STEEL METALLURGIST: Experience includes two years in fabrication, two years in research, four years in steel mill from melt shop to cold strip mill. Diplomatic, aggressive record. B.S. degree, married, veteran, age 29. Will favorably consider position in operating department or operations affiliated with metallurgical position. Box 4-60.

SALES ENGINEER: Age 38. Last eight years as sales engineer for manufacturer of ferrous and nonferrous alloys. Previous five years manufactured alloy, stainless steel and high-temperature alloy screw machine products. Four years laboratory and production experience in large brass mill. Graduate training in metallurgy; undergraduate degree in chemistry. Can travel. Box 4-65.

METALLURGIST: B.S. degree, age 36, family. Nine years experience in technical supervision, development, engineering and manufacturing problems, materials testing and evaluation. Background includes fabrication, welding, heat treatment, casting and forging of high-temperature alloys, stainless steels, ferrous metals, titanium and aluminum. Western states preferred. Resume on request. Box 4-70.

METALLURGIST: B.S. in metallurgical engineering. Eight years research and development experience including laboratory supervision, manufacturing problems, failure analysis, material selection, testing and evaluation. Experience encompasses wide range of materials and processes. Prefers production or laboratory position in Northeast. Box 4-75.

METALLURGICAL ENGINEER: B.S., M.S. degrees, with 17 years ferrous and nonferrous experience including research, industrial experience in heat treating, materials control and processing operations. Presently employed as chief metallurgist. Desires responsible position in Metropolitan New York area. Box 4-80.

METALLURGICAL ENGINEER: Degree, age 38, family. Eleven years experience includes supervisor in research and development foundry working on high-temperature alloys and production problems, extractive metallurgy process development, large plant layout and four years as department superintendent including technical process development. Location not important. Box 4-105.

ADMINISTRATIVE ENGINEER OR EXECUTIVE ASSISTANT: M.S. degree, metallurgical engineering. Age 30. Training in industrial engineering and management. Nine years ferrous and nonferrous industrial experience in casting, heat treating, working, fabricating, including automotive and aircraft. Proven ability for product development, profit improvement. Technical papers published. Will relocate. Resume on request. Box 4-110.

PRODUCTION SUPERINTENDENT OR SALES: Age 41, married, two children. Desires position with responsibilities. Experienced in high-vacuum technology and corrosion. Extractive metallurgy primarily in titanium from research through production. Well versed in administrative duties, costs, production and personnel. Quality of product assured. Box 4-115.

METALLURGICAL ENGINEER: B.S. degree plus business training. Age 26, veteran. Experience includes electric furnace and open-hearth melting (superalloys, stainless steel, alloy and plain carbon steels), and initial hot working, thick-walled pipe manufacture. Research and development work conducted in ultra high strength and high-temperature alloy and vacuum melting field. Desires production, production development or technical sales work with opportunity for advancement into a supervisory capacity. Box 4-120.

scientists and engineers

NUCLEAR CAREERS NOW

in worldwide reactor program

Openings at all experience levels

ANALYTICAL	**Reactor shielding:** Advanced studies and analysis. **Reactor core:** Analysis, nuclear and reactor core. **Systems analysis:** Including engineering direction on reactor plant design—heat transfer, thermal stress, fluid flow, etc. **Heat transfer:** Direct analysis studies—reactor systems, dynamics and thermodynamics of fluid flow. Openings also in preliminary analysis, reactor operations, stress analysis, and integrated areas. Degree essential. Experience as required.
DEVELOPMENTAL	**Metallurgists:** R. & D. on nuclear fuel materials, including radiation effects, evaluation of uranium and thorium alloy, ceramics. Also for mechanical fabrication development for these materials. **Engineers—ME & ChemE:** For development of power reactor components. Devise experiments, perform tests, prepare reports. Stimulating problems in fluid dynamics, heat transfer, full scale and model studies of fluid system components, remotely operated handling equipment, etc. Other openings with nuclear experience preferred but not essential. Degree and applicable experience required.
DESIGN	**Control mechanisms:** Senior openings, original design—including control rods, safety rods, drives, allied tooling. Also mechanical design (light and heavy) and general machine design. **Electrical:** Originate and develop major control and power systems and components. **Process systems & equipment:** Prepare layouts and specs.—pumps, heat transfer equipment. **Process instrumentation:** Reactor, auxiliary, and control systems. **Facilities—mechanical systems:** Original design—heating, ventilating, special atmospheric controls for pressure regulation, cleaning, etc. Assist on mechanical design, special handling systems, etc. **Machine design:** Heavy mechanical. Original test equipment for nuclear experiments—lead-shielded casks, remote handling cranes, etc. Machine design experience essential. **Reactor core components:** Design moderator cans, fuel elements, critical assemblies, grid plates, core supporting structures.

Other opportunities in:
Theoretical, Experimental, Solid State Physics, High Temperature
Physical Chemistry, Health Physics, Materials Research.

New programs add to years-ahead backlog

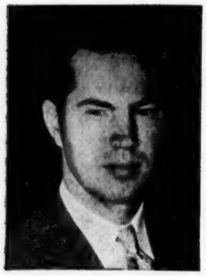
Atomics International has built and is operating two power reactors—the Sodium Reactor Experiment and the Organic Moderated Reactor Experiment. Central station power plants based on these reactor concepts are in the planning stages right now. In addition, AI has just begun an advanced power reactor study for Southwest Atomic Energy Associates, a group of 15 investor-owned utility companies.

AI is expanding overseas operations. With 5 foreign reactors already in operation or being built, AI recently signed agreements with ASEA of Sweden, which has offices in 50 countries, and DEMAG of West Germany, with whom AI formed the new company, INTERATOM, in Duisburg, West Germany.

Write today for more details about exciting career opportunities at AI.

Mr. D. D. Newton, Personnel Office, Atomics International
21600 Vanowen Street, Canoga Park, California
(In the suburban San Fernando Valley, near Los Angeles)

ATOMICS INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION, INC.



MEI'S DIRECTOR SPEAKS

To Men Who Want To Get AHEAD

In this "satellite age" . . . this age of specialization . . . this age when the advertisements always read "*Trained* Help Wanted," do you find your progress hampered by lack of knowledge or outdated knowledge? Are college classes too far away from home . . . too crowded for personal attention . . . their subject matter too general for your very specific needs?

METALS ENGINEERING INSTITUTE has been established for YOU . . . to help YOU gain the knowledge you want and need to get ahead—in the comfort of your own home—with the aid of your personal "instructor-by-mail"—AND with a course pinpointed solely to YOUR needs.

MEI furnishes all the materials—no extra trips to the library or bookstore—a sturdy, handsome binder to hold notes and lessons, postage paid envelopes, the invaluable Metals Handbook published by the American Society for Metals, and fifteen complete, fully-detailed, easy-to-understand lessons . . . written exclusively for MEI by industry experts. The lessons are supplemented by review questions which will be carefully corrected and promptly returned to you—along with helpful comments. Your special questions will also be answered quickly and completely.

When you have finished the course, a hand engrossed Certificate of the Metals Engineering Institute is yours to display in your den or office and to remind your employer that you are a man who has obtained specialized knowledge that will be useful to him and, therefore, worth advancement to you. If you desire, regular progress reports will be sent to your employer as you study.

The hours you study are those you choose to use—spare time that can put you years ahead in your chosen field, the booming metal industry. The place you study is also yours to choose—your office, your den, your back yard on a sunny afternoon.

Take a moment NOW to insure your future. Simply check the courses below in which you are interested and mail the coupon to MEI today. Complete information will be sent to you at once. Take advantage of MEI's complete, up-to-date package of specialized knowledge written specifically for YOU. If you are interested in a course not yet released, send the coupon anyway. Then you will be assured of receiving detailed information the instant YOUR course is available.

Anton deS. Brasunas

Anton deSales Brasunas, Director
METALS ENGINEERING INSTITUTE

Dr. Anton deSales Brasunas was appointed Director of the Metals Engineering Institute after a long search for just the right man who, by education and experience, would most ideally qualify for this important post. Dr. Brasunas came to MEI from the University of Tennessee where he was Associate Professor of Metallurgical Engineering. Prior to that time, he was associated with the Oak Ridge National Laboratory and with Battelle Memorial Institute. He is a graduate of Antioch College, received his MSc. degree from Ohio State University, his Sc.D degree from Massachusetts Institute of Technology.

MEMO TO Training Directors and Employers

MEI Study Courses are ideally adapted for in-plant, on-the-job, or after-hours training. Cleveland Pneumatic Tool, Wallingford Steel, General Electric, Tube Turns, Sheffield Steel—all these and others—are making excellent use of MEI courses.

These Courses help your Sales Executives gain greater appreciation of customers' metals problems . . . help Production Men improve and advance in their work . . . Engineers can specialize or take refresher courses that will update their knowledge . . . Management in the midst of metals problems may benefit from sitting in on these courses.

MEI offers Training Directors and Employers a complete package, easily presented and having all the appeal and attractive prestige, all the nationally-recognized authority of the American Society for Metals. You may ask assistance in securing instructors or study courses can be presented by your own metals expert, with full cooperation from MEI's Headquarters Staff.

You can encourage employee education and training with the handy Bulletin Board Poster pictured above—now available for office, plant, or laboratory display. Poster Pockets contain course information folders and postage-paid inquiry cards.

Help your employees help themselves to knowledge. Mail the coupon below for this colorful poster for display at your company. Or write to us about a group course at your company.

Metals Engineering Institute

7301 Euclid Avenue, Cleveland 3, Ohio
We can display these Bulletin Board Posters. Send me the number indicated below. No charge, of course.
Indicate the Number of Posters Needed for Display.

☐ PLANT........ ☐ LAB........ ☐ OFFICE........

Name..

Title..

Co. ....

Address..

City.................... Zone.... State.........

CHECK AND MAIL TODAY . . . . . . NO OBLIGATION

Metals Engineering Institute

7301 Euclid Avenue,
Cleveland 3, Ohio

Give me promptly the details on the courses I have checked at the right—the courses that are ready now.

I have also checked those courses in the *future* columns—courses that may appeal to me when you have completed them.

This Coupon May Mean Success— A Year From Today

There is no obligation on my part in the return of this coupon.

Name ....

Street and No. ....

City .... Zone..... State.........

Co. ....
(fill in this line if you wish)

THESE COURSES ARE AVAILABLE NOW
- ☐ Elements of Metallurgy
- ☐ Heat Treatment of Steel
- ☐ High Temperature Metals
- ☐ Titanium
- ☐ Metals for Nuclear Power
- ☐ Stainless Steels
- ☐ Electroplating and Metal Finishing
- ☐ Gray Iron Foundry Practice
- ☐ Oxy-Acetylene Process
- ☐ Steel Foundry Practice
- ☐ Primary and Secondary Recovery of Lead and Zinc
- ☐ Steel Plant Processes

THESE COURSES WILL BE AVAILABLE JUNE 1, 1958
- ☐ Copper, Brass and Bronze
- ☐ Magnesium
- ☐ Tool Steels
- ☐ Fundamentals of Ferrous Metallurgy
- ☐ Arc Welding
- ☐ Blast Furnace Operations

THESE COURSES ARE IN PREPARATION
- ☐ Aluminum
- ☐ Beryllium
- ☐ Alloy Constructional Steels
- ☐ Alloy Castings
- ☐ Steel Selection for Design Engineers
- ☐ Zirconium
- ☐ Mechanical and Physical Testing of Metals
- ☐ Inspection of Metals
- ☐ Corrosion of Metals
- ☐ Powder Metallurgy
- ☐ Cold Forming
- ☐ Forging
- ☐ Machining
- ☐ Fundamentals of Welding and Joining
- ☐ Resistance Welding
- ☐ Basic Openhearth Steelmaking
- ☐ Electric Arc Furnace Steelmaking (Carbon and Low Alloy Steels)
- ☐ Electric Furnace Steelmaking (High Alloy Steels)
- ☐ Malleable Foundry Practice
- ☐ Molding and Casting Processes
- ☐ Nonferrous Foundry Practice

furthering creative technology at

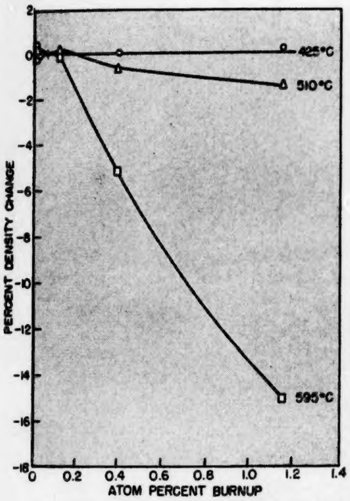
The KNOLLS ATOMIC POWER LABORATORY

The significant relationship between advances in materials and processes, and advances in nuclear propulsion systems has generated a continuous program of original investigations in metallurgy and ceramics at The Knolls Atomic Power Laboratory.

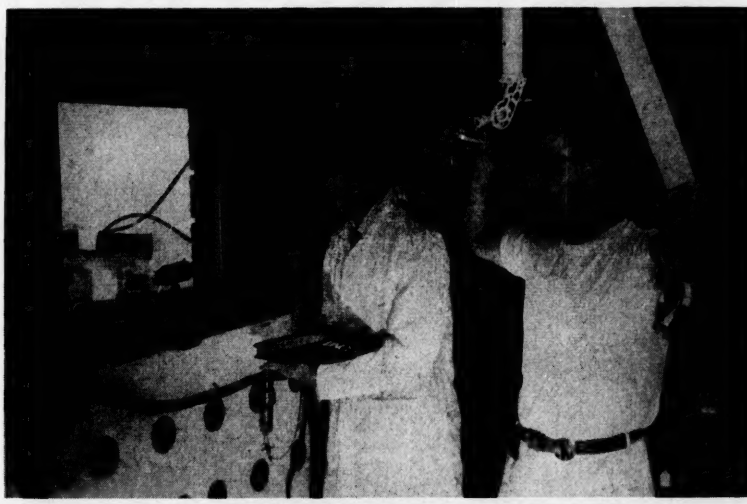
Currently the Laboratory is working toward the design of power reactors for operation at higher temperatures and with higher fuel burnups. A typical materials problem is the swelling and blistering of fuel elements caused by the agglomeration of inert gases (Kr and Xe) formed during nuclear fission.

• • •

An example of the physical-metallurgical studies now under way in this area is the experimental work described below.



DENSITY CHANGES IN ZIRCALOY CLAD 8 w/o URANIUM-ZIRCONIUM ALLOYS ON POSTIRRADIATION ANNEALING



Dr. W. V. Johnston (left) recording data at post irradiation annealing cell.

POST-IRRADIATION ANNEALING OF URANIUM-ZIRCONIUM ALLOYS

To obtain information on the agglomeration mechanism and the extent of damage experienced, specimens of an 8 wt % enriched uranium-zirconium alloy which had been irradiated to a maximum of 42% of the U-235 atoms fissioned were annealed in vacuum furnaces at 425, 510 and 595°C. Percent density changes were determined as a function of temperature at an annealing time of 500 hrs. As can be seen in the graph, specimens of all burnups were stable at 425°C but volume increases of up to 15% were obtained at 595°C.

Additional information on the amount and rate of Kr and Xe diffusion and release from the fuel elements has been obtained by using β and γ counting techniques. The effects of irradiation and annealing on the temperature of phase transformations and on alloy structures are being studied by measurement of electrical resistivity, and use of advanced metallographic techniques.

PROFESSIONAL OPPORTUNITIES

There are openings at the Laboratory for metallurgists and ceramists interested in development, application and fabrication of nuclear core materials. Degree is required; advanced degree and/or related experience preferred. (U.S. Citizenship) If you qualify, please send resume, including salary requirement, to: Mr. A. J. Scipione, Dept. 41-MP.

Knolls Atomic Power Laboratory

OPERATED FOR A. E. C. BY

GENERAL ELECTRIC

SCHENECTADY, NEW YORK

A. S. M. PHOTOCOPY SERVICE

A.S.M. Photocopy Service is available only for articles identified by an asterisk in the A.S.M. Review of Metal Literature. For articles not marked with an asterisk, please refer your request to either the Engineering Societies Library in New York, the John Crerar Library in Chicago, or the Carnegie Library in Pittsburgh.

Please order by item number immediately preceding the asterisk. Payment of $1.00 per page or fraction thereof is requested in advance (number of pages is shown in the journal reference). Where advance payment is not feasible, a surcharge of $1.00 is made to cover billing costs.

All photocopies will be provided in the form of positive paper prints of normal size.

In offering this service the American Society for Metals attempts to follow the "fair use" interpretation of the copyright law. A.S.M. therefore does not sell the photocopies but merely performs the service of copying. The applicant for this service must agree to the following conditions:

1. Not more than one copy of any work is requested.
2. The photocopy is requested solely for personal use in research and study.
3. The applicant will not publish or further reproduce the material without first securing the permission of the copyright owner.
4. The applicant will hold the A.S.M. harmless from any claim that may arise from supplying him with the photocopy.

Photocopy Service Order Form

A.S.M. Photocopy Service
7301 Euclid Ave.
Cleveland 3, Ohio

Please send me one photocopy each of the following documents (which are identified by an asterisk in the A.S.M. Review of Metal Literature):

Item No.	No. of Pages	Cost at $1.00 per page
________	______	________
________	______	________
________	______	________
________	______	________
________	______	________
	Total Cost	________

Payment is enclosed________

Please bill me and add $1.00 to cover billing costs______

I agree to the terms specified above as to "fair use" under the copyright law

____
Signature

Name ________________________
(Please Print or Type)

Address ________________________

Company ________________________

Street ________________________

City________________ Zone_____ State_____